



# ELECTRICAL

INSTALLATION ENGINEER

## NEWS LETTER

TAMILNADU ELECTRICAL INSTALLATION ENGINEERS' ASSOCIATION 'A' GRADE (Regn. No. 211/1992)

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ISSUE NO.181

VOL : No. 16/2021

MONTHLY ISSUE NO.8

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DECEMBER 2021



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## EDITORIAL

Dear Members, Fellow Professionals and Friends,

*Greetings To All!*

*Happy Christmas Greetings!*

*Advance Greetings For A Happy New Year 2022!*

We had a tough 2020 but a tougher 2021 with more serious 2<sup>nd</sup> wave of Covid 19, with all related social and economy problems with all kinds of challenges to people, Businesses and the Governments. Medical advancements and our past experiences of the 1<sup>st</sup> wave helped us to navigate through the year which is coming to an end this month. The year closes with encouraging situation of more than expected economic recoveries and a manageable numbers of fresh Covid cases and so on. We have galloped fast in vaccination setting a World Record, which gives us abundant hopes of return of normalcy and the Economy getting back to its normal and higher growth levels. As per experts, we have the potential to grow at the rate of 10% per year from the year 2022, which can put us at a strong position in the Global Economic Map. The Global developments post pandemic are also encouraging for us to plan and achieve sizable growth.

At this point of time, there are increased concerns globally about the Planet and the People due to environmental issues and threats of Global Warming and the serious consequences. There are international meets and discussions and agreements particularly about '**De Carbonization**' and the world is discussing about "**Net Zero Emission by 2050**". In the recent COP26 at Glasgow, our Country has pronounced that we will aim at "Net 0 Emission by 2070" with technology support from various countries. Our problem can be understood from the fact that we still depend on 'Fossils' like Coal and Oil and Natural Gas for almost 75% of our energy needs, particularly for Electricity and Transportation Fuel. We have lot of plans and progress with Solar Energy and Bio Energy to reduce Coal and Oil, but we still have a long way to go. This is where the technology supports could be of great help, particularly in the field of Bio Energy to produce Bio Coal, Bio Carbon and Bio Crude from all surplus and wastes of Biomass. Appropriate technologies can ensure to maintain the balance of Energy extraction without depriving any of present uses and requirements.

We have the Energy Conservation Day on 14<sup>th</sup> of December and Farmers, Day on the 23<sup>rd</sup>. Our needs and operations are quite substantial in both these areas. We have rightly focused on Energy Efficiency and Renewable Energy for over 20 years now with good progress but we need to accelerate our work in more areas with deeper penetration. There can be a sizable contribution from agricultural operations too if the entire Lift Irrigation can be shifted to Solar Pumps and the Government of India has already initiated programmes in this direction.

It is interesting that during the Deepavali celebrations in November, it was almost a global celebration in various countries of the World with Greetings from various heads of States from the US to UK to South Korea to Israel to many countries of the World. It is recognized as the Festival of Lights symbolizing removal of darkness from everything everywhere. It is believed that it could soon become a significant Global Festival like the Christmas and Ramzan and Indians can be proud about it.

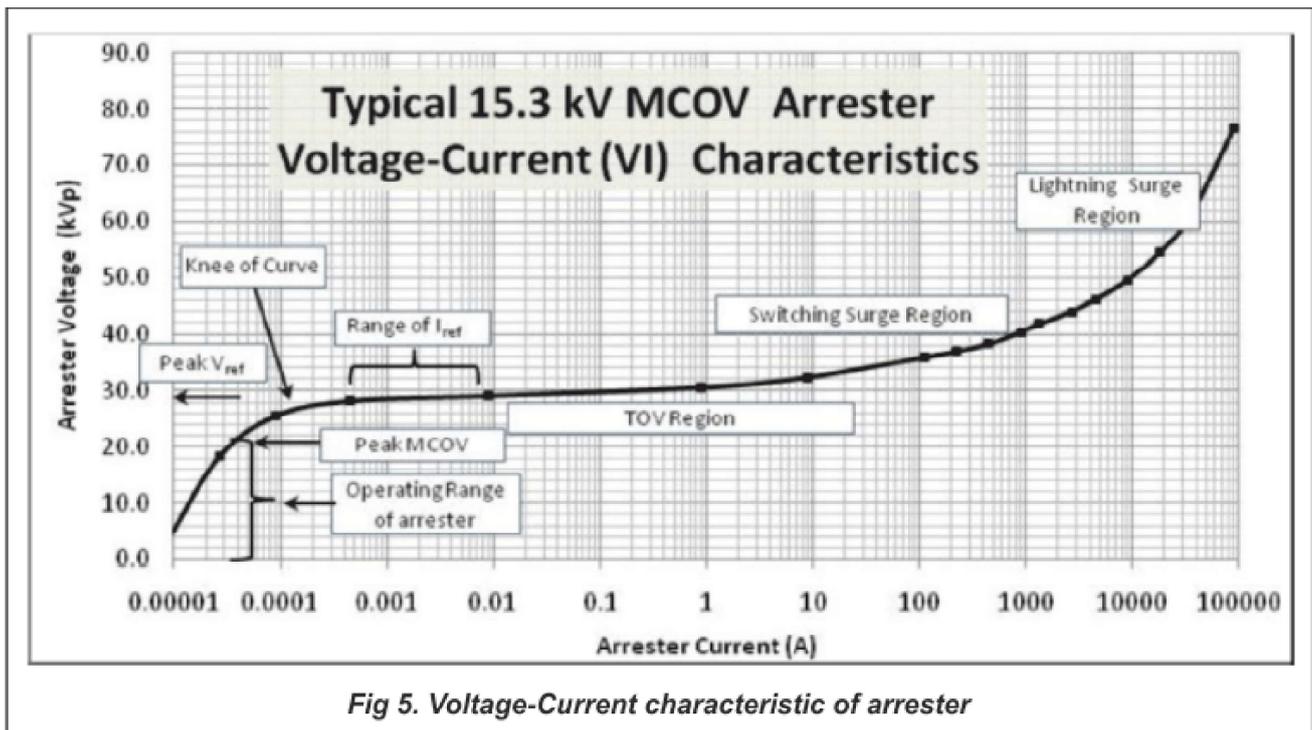
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**Editor**

## 6. What is the importance of V-I characteristic of MOSA?

### (i) V-I Characteristics of a MOSA

In order to study the performance of the surge arresters under different operating conditions, the plotting of arrester V-I characteristic is essential. The arrester V-I characteristic is one of the fundamental methods of displaying the operating behavior of an arrester. This typical curve is used in several ways and is greatly relied upon to predict the performance of an arrester. It also facilitates the performance mapping of the entire arrester assembly. Fig 5 shows a typical V-I characteristic of a 15kV Maximum Continuous Operating Voltage (MCOV) arrester.



In this context, the explanation of a few related terms is furnished as follows

- Protection Levels of the arrester — Discharge voltage levels of the arrester when it successfully discharges / diverts the lightning impulse and Switching Surges

#### Reference Voltage ( $V_{ref}$ ):

It is the lowest power-frequency voltage (in rms), independent of polarity-when it is applied across the arrester terminals. The arrester yields a resistive current component which is equal to the reference current of a single Metal oxide block or full assembly of arrester blocks. For the multi-unit arrangement of arrester, this reference voltage is the sum of the reference voltages of the members of the each series unit. This voltage level is to be specified by arrester manufacturer.

#### Reference Current ( $I_{ref}$ ):

The power-frequency current (rms), which is sufficient to diminish / nullify the effects of the capacitance of the arrester, This current level is also required to be specified by the arrester manufacturers (normally it is in the range of 1.0 mA/sq.cm of disk area).

### **Operating Range:**

The operating region as shown in a V-I characteristic curve, (where the arrester spends its entire life span) indicates its normal operating status. Then a very small leakage current flows through it. The magnitude of this current varies with the ambient temperature and the level of pollutants deposited on the arrester housing as well. It also varies depending upon the arrester makes and the voltage ratings i.e. no reference or benchmark level has been fixed for this leakage current.

### **MCOV:**

This refers to the power frequency voltage that appears across the arrester when it is exposed to maximum voltage stress during its normal operation. The value of MCOV (Maximum Continuous Operating Voltage) level is in the range of 70 to 85% of the  $V_{ref}$

### **The Knee of the Curve:**

This is the region where the arrester starts its transition from non-conduction state to a conduction state. This operation displays a soft bend known as the knee of the curve. Generally, it happens when the applied current reaches 1 mA or more.

### **Temporary Over Voltage (TOV):**

The TOV section starts just above the knee curve and it covers the  $V_{ref}$  point also. This phase stretches up to tens of amps when impressed with power frequency voltage (between 0.1 sec and several hours). This kind of arrester operation happens when very high power frequency over voltages are present in the system due to ground faults. Several other factors also bring this over voltage condition. This voltage is comparatively high for the arrester; then it is open to the flow of very high current through it. If this voltage is not controlled / regulated in time, it will lead to the “thermal runaway” of the arrester and finally its total destruction.

### **Switching Over Voltages:**

These high energy, slow front over voltages occur during the Switching operations in the network. They constitute heavily damped oscillations with a magnitude up to 3 p. u and with a frequency extended up to several KHz. The magnitude of this over voltage may reach up to 4 p. u. during Inductive Switching operations.

### **Lightning Over Voltages:**

These fast front over voltages originate from the electrical discharges brought by charged clouds in the atmosphere. Lightning surge attains its peak within a few microseconds and decays very rapidly (1.2/50 microseconds wave). Its magnitude goes up to several hundred kilo volts per unit; being a natural phenomenon, its voltage level and energy content cannot be easily predicted.

### **7. Briefly explain with illustrations the “STAND OFF” between the MOSA and the waves that constitute the over voltage spectrum. i.e how MOSA, behaves under various over voltage surges?**

This “Stand Off” fig 6 consists of three distinct phases. It simply represents the race between them. Or in other words, it throws light on the Road travelled by the arrester before its “Turn On” or “Crash”. In this context, we need to take note of several messages before proceeding further.

- (i) The main duty of the arrester is either to prevent or to divert the current surge that crosses its path and safe guard the equipment that are placed under its protection. In performing this duty, it suffers much – at times sacrifices / loses its life. On all occasions, it has to make a race with the intruding current surges. This perfect spilt second race (nano / micro seconds) compares well with other races like Olympic running race in real life.

(ii) The present head count states that MOSA initiates action against all the surges covered by the over voltage spectrum but its success rate against nano second VFTOs is poor. i.e. such encounters are not “enthraling”. Most of the times the arrester loses the race. Hence this kind of encounter demands an effective remedy. So a method to break this pattern of the arrester inactions and to bring higher arrester success rate in the races becomes essential.



**Fig 6. Stand Off between MOSA and Invading vicious over voltage surges**

**Phase I:** Initial reaction / Response of the arrester and its voltage building activity across its discs.

**Phase II:** Transition of the arrester from its “Capacitive Mode” to ‘Resistive Mode’ starts; stray and block capacitance (which sides with the invading current surge) peeps its ugly head and weighs down / slows down arrester transition movement. Its severity is mainly felt when the arrester faces VFTOs. i.e. the capacitive effect is the main game changer.

**Phase III:** It presents the end result of the race thus observed between the peaks of arrester discharge voltage and that of the current surge. This phase reveals whether the arrester “Turns On” or (crashes on / Bows out), To put in simple terms, whether the arrester successfully handles the invading current surge or simply remains “Inactive”.

**Main players in this duel are,**

- (i) Combined effect of the steepness (front time) and magnitude of invading current surges.
- (ii) Peak of Arrester Discharge Voltage
- (iii) Fringe player (i) Stray electric fields and the block and stray capacitances

All these may be treated as the sides of a “triangle” or “tripod” for better understanding of the events involved in the arrester’s Turn On

***We abuse land because we regard it as a commodity belonging to us.  
When we see land as a community to which we belong, we may begin  
to use it with love and respect. – ALDO LEOPOLD***

## 8. What is churning inside the MOSA unit when its status moves from “Capacitance to Resistance”?

- Over voltage surges enter in the protective zone of MOSA
- Quick fall or decay of the capacitance present in the circuit starts (Initial response of arrester – game changer moment)
- Race or tug of war between the peak of invading current surge and that of discharge voltage begins. During this race period, the arrester is subjected to much stress – suffers much as its discs get strangulated between the jaws of incoming current surge and the arrester discharge voltage. This critical situation of the arrester elements can be likened to its sitting on a “Knife Edge” or caught between the jaws of a “Nut Cracker”. Now the match is evenly poised.
- This pulse racing situation goes on till the arrester reaches its Resistant Mode which sets the final result down to wire. This shows how the arrester makes the good fight or arrester – O/V surges Standoff process.

$(T_d = \text{Delay time} = (T_c - T_f) \text{ microseconds})$

$T_c = \text{Arrester conduction time}$

$T_f = \text{Front time steepness of incoming surge}$

When  $T_d$  is positive the incoming current surge wins the race i.e. the arrester folds and permits the flow of invading surges in the circuit to impact the protected equipment)

When  $T_d$  is negative, the MOSA Turns On and wins the bout and safe guards / protects the equipment.

Fig 6. Stand Off between MOSA and Invading vicious over voltage surges

From the facts out lined above, the main inferences drawn are,

- The operation of MOSA is comparable to the movements of a “Roller Coaster” (highs and lows) which depend on the factors like magnitude and front time of incoming current surge, capacitance present in the circuit and the capability of the MOSA to meet all the challenges thrown at it.
- Adequate time should be made available for the disappearances of capacitance present in the arrester circuit. Otherwise MOSA will find itself in seemingly impossible situations in its bouts against the invading surges.
- The role of the fringe player viz. stray and block capacitance can be compared to that of a Double Edged Sword i.e it can either “Kill or Save”. It is because it saves the arrester outer shroud (insulator Cover) from over voltage surges but kills / delays the operation of arrester and there by shortens its life.

*(To be continued)*



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***Man is still the greatest miracle and the greatest problem on this earth.***

***– DAVID SARNOFF***

# LEARNING MANAGEMENT BACK FROM ELECTRICAL SYSTEMS

## INTRODUCTION

*Electrical systems have been present since the dawn of the Industrial Revolution and there are few products today which are running without electrical systems built into them.*

*The definition of nature in the immediate past was living amongst birds and bees in farms abounding with cattle. A ride would be on horse or bullock cart and most activity would be manual. Now we are swarmed with machines and live in a virtual world. They are omnipresent and we may not be able to live without them.*

*It is now a known fact that children are able to identify electronic products and brands better than identifying birds and bees! Astonishingly it is only a step forward now to derive management principles from machines and their inherent processes and safety procedures to operate them.*

*And electrical engineering being the mother of Industrial revolution has much solutions to managerial problems to offer.*

## PART-1 – A SURPRISE OF HOW WE CAN LEARN MANAGEMENT LESSONS FROM ELECTRICAL SAFETY SYSTEMS

We are all aware of a number of guidelines of how to handle electrical systems and ensure our life and safety. Dwelling deep into the same, we would be surprised that the same guidelines can help us find solutions for many of our problems as well.

Are you surprised? Here below are a few examples.

<b><i>ELECTRICAL SYSTEM GUIDELINES TO SAVE HUMAN LIVES AND PROTECT PROPERTY(DO'S)</i></b>	<b><i>MANAGEMENT GUIDELINES TO HARNESS POTENTIAL OF EMPLOYEES, CLIENTS AND BUSINESS (DO'S)</i></b>
Electric shocks are easily received, but can also be easily avoided by observing the safety rules scrupulously.	Management shocks are also inevitable, but can also be easily avoided by getting feedbacks from employees and others!
Switch off the supply before handling a fan or replacing a bulb.	Before you handle sensitive personnel, identify who is triggering their action and cut the link.
Ensure that all the controlling switches are opened and locked or the fuses withdrawn, before working on any circuit or apparatus.	Before you transfer or relieve an employee, ensure his current assignments are totally completed and the links are severed clean.
Use the correct size and quality of fuse wire when renewing blown fuse.	Replace existing manpower with one of equivalent skillsets. <b>Shortcuts only short circuits.</b>
See that all splices and connections are securely made.	When you assemble personnel for any project, have them interact with each other well, have their operational connectivity defined and work will go on successfully.
Examine before use all safety appliances such as rubber gloves, safety belts, insulation mats, ladders, goggles, ropes etc. for their soundness.	Set a mechanism to routinely check the capability of personnel and equipment to ensure their fitness and suitability for the jobs.

Concentrate on the work you are doing. Haste and carelessness cause many accidents.	Concentrate. Concentrate. Concentrate. Encourage even juniors to keep “Don’t disturb boards” and respect it when you see one. <i><b>DO NOT DISTURB</b></i>
Warn others when they seem to be in danger near live conductor or apparatus.	Be altruistic.
Attend at once to all injuries however slight they may be.	When an employee comes to you with a problem, however small, do not ignore the employee or the problem.
Place ‘MEN WORKING’ sign Boards on all switches before commencing work. This will prevent unauthorized personnel from accessing the live parts of machines.	Avoid uncontrolled access to critical data of the organization. Allocate proper responsible personnel for each job and inform clients accordingly. Also, do not tweak schedules and show the same manpower or tools working on different projects.
<b>ELECTRICAL SYSTEM GUIDELINES TO SAVE HUMAN LIVES AND PROTECT PROPERTY (DON’T’S)</b>	<b>MANAGEMENT GUIDELINES TO HARNESS POTENTIAL OF EMPLOYEES, CLIENT AND BUSINESS (DONT’S)</b>
DO NOT use fire extinguishers on electrical equipment unless it is clearly marked as suitable for that purpose.	Know laws of disciplinary action which are allowed to be taken for various crimes / situations and do accordingly.
DO NOT use a ladder without a lashing rope, otherwise the ladder should be held firmly by another person.	Have a proper support and backup for your actions. The inspiration may be yours, but your perspiration alone may not make the effort to succeed.
DO NOT bring a naked flame near any oil filled equipment or batteries. Smoking in such areas are strictly prohibited.	<b>Do not incite a wrong situation. In the long run, you may become the victim to it.</b>
DO NOT allow visitors and unauthorized persons to touch or handle electrical apparatus or come within the danger zone of H.V. apparatus.	Take suggestions from all but carefully analyze and then implement the most apt suggestion. Also when a company is taken over, make a positive step to weed away bad practices from the parent company and only take good practices from the bought-out company.
DO NOT enter excavations and cable trenches without proper verification for dangerous gases, sharp objects, slippery or loose flooring, dangerous insects, improper ventilation, congested areas etc.	Do not enter into wrong alliance. SO SIMPLED.
DO NOT think that turning away one’s face is enough to protect oneself from an arc flash. A full body protection based on requirements to be adorned.	Just avoiding or deflecting employee queries wouldn’t help in the long run. Be prepared for full analysis and self-introspection.

DO NOT treat circuits as dead until, they are proved to be dead.

DO NOT close or open a switch of fuse SLOWLY OR HESITATINGLY.

Once you are positive of the action, do it quickly and FIRMLY.

The inference: Hence, it suddenly becomes so easy – you see any safety guideline on electrical systems, you can find solution to your managerial problem. Conversely, define your managerial problem, then review your safety guideline checklist – you will find a solution.

### **A brief about the Author**



*Mr. K. Muthukrishnan is a proud second generation member of TNEIAAG (his father Late Mr. H. Kalyanasundaram a well known electrical engineer was also a proud member of TNEIAAG).*

*Mr. K. Muthukrishnan is a Master's Degree Holder in Industrial Safety Engineering. Has a successful career spanning 30+ years with a rich experience in consulting and contracting safety and security systems for various sectors including Automobile, Banking, Chemical, Commercial, Hydrocarbon, Pharmaceutical, Steel and Thermal Sectors.*

*Necessity drove him to study electronics and computers deeply and suddenly it had dawned upon him that while machines have been made by man, they have started becoming better than us because the scientist or engineer who makes the machines, dwells deeply into our human requirements and also the mistakes that we do and incorporated beautiful processes, algorithms, instruments in the machines to fulfil the requirements.*

*He then started observing the machines like Automobile, Civil Engineering Systems, Electrical Systems, Computer Technology, Human Behavioural Sciences, Material Handling and Safety related Systems etc., in a deeper perspective, and was surprised how much information was available at our disposal to be re-discovered.*

*This led him to publish the book "LEARNING MANAGEMENT BACK FROM MACHINES" available in Amazon.in*

*For any professional consultation and feedback and further discussions about the ideology manifested in this book, he invites to be reached via his email and mobile below:*

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***The global environment crisis is, as we say in Tennessee, real as rain,  
and I cannot stand the thought of leaving my children with  
a degraded earth and a diminished future.***

***- AL GORE***

# ELECTRICAL MAINTENANCE UNIT

## (QUESTION & ANSWERS) - 11

191. What are the types starters used for starting of induction motor?

- a. Direct on line starter (air break) mechanically.
- b. Direct on line starter (air break or oil immersed) electrically.
- c. Star delta starter.
- d. Slipring motor starter.
- e. Auto transformer starter.

192. What are the speed control methods of induction motor?

- a. By controlling the supply voltage.
- b. By controlling the supply frequency ( $N_s = 120f / P$ ).
- c. By varying the number of poles ( $N_s = 120f / P$ ).
- d. By rotor rheostatic control (for small speed variation).

193. What is magnetic locking or cogging effect of induction motor?

In squirrel cage induction motor sometimes the rotor and stator core teeth or slots are comes face to face or parallel at stationary condition. If we are starting the motor at this condition the motor get hesitated to start or run due to the attraction developed between those rotor and stator teeth or slots. This is known as the magnetic locking or cogging effect of a squirrel cage induction motor. This type of magnetic locking in squirrel cage induction motor can be avoided either by skewing the rotor slot or by selecting the rotor slot, such that there is no common factor between the rotor slot and stator slots.

194. What is skewing?

Skewing can be done by turning the rotor slots about  $15^\circ$  from the parallel position of slots with the shaft. That is rotor slots are not in parallel with the shaft but there is an angle of about  $15^\circ$  with the shaft.

195. What are the losses in induction motor?

- a. Stator losses (stator copper losses, stator iron losses).
- b. Rotor losses (rotor copper losses, rotor iron losses).
- c. Windage and friction losses.

196. What is synchronous motor?

An alternator, which is running as a motor can be called as synchronous motor and it runs at synchronous speed while it converts electrical energy into mechanical energy. It requires both AC for armature and DC supply for field.

197. What are the advantages and dis-advantages of synchronous motor?

### **Advantages**

- a. It's a constant speed motor and is equal to synchronous speed from no load to full load.
- b. It has good efficiency higher than induction motor.
- c. It can be run as a motor and also as an alternator as per the requirement. Moreover it can be used as synchronous condenser.

### **Dis-advantages**

- a. It cannot be used as a varying speed motor. Because its speed cannot be varied.

- b. As a motor it is not self-starting type and it cannot be started on load.
- c. It requires both AC and DC supply.
- d. Hunting is also produced in this motor.

198. What are the applications of synchronous motor?

- a. These motors are used in powerhouses, in sub stations for the improvement of power factor by connecting it in parallel to the supply and it is run without load under over excitation of field.
- b. Used in big industries where many induction motors are installed to improve the power factor.
- c. Used for constant mechanical loads.

199. What is hunting effect?

When the load is varied to the motor the oscillation being setup in the rotor about the position of equilibrium corresponding to change of load condition. So the damper winding acts the magnetic lines of force and causes to create the opposite torque, which keeps the rotor in the same position of the particular load. This oscillation of the rotor is known as Hunting or Phase swinging. To reduce this hunting damper winding is helpful.

200. What is synchronous condenser or phase advancer?

An over excited synchronous motor takes leading current just like a condenser and gives leading power factor. A synchronous motor, which I used only for the purpose of improving power factor, can be called as synchronous condenser or phase advancer.

201. Why single-phase motors are not self-starting?

When a 1 $\phi$  supply is given to the single winding of the single phase motor, the field produced by it changes in magnitude and direction sinusoidally (pulsating flux). Such an alternating field is equivalent to two fields of equal magnitude and speed rotating in opposite direction. Such rotating magnetic fields produce two torques on the rotor. So the rotor cannot rotate in any direction. Because the net torque developed by the motor is equal to zero. So a single-phase motor is not self-starting.

202. What are the methods to self-starting of single-phase motor?

- a. Splitting one phase into two phases.
- b. By using capacitor.
- c. By using repulsion method.
- d. By shading the poles.
- e. By connecting the field in series with the rotor having winding with commutator (AC series motor or universal motor).

203. What are the methods to control the speed of single phase motor?

In AC single-phase motors speed control cannot be achieved as smooth as in DC motor. There are following few methods of speed control.

- a. By changing the number of poles of stator.
- b. By changing the applied voltage to the stator.
- c. Frequency control method.
- d. Rotor rheostat control.
- e. By operating two motors in concatenation or cascade or tandem method.
- f. By injecting an emf in the rotor circuit.
- g. By changing slip.

204. What are the classifications of electrical measuring instruments?
- Absolute instruments. These instruments give the value of the quantity to be measure in terms of the constant of the instrument and their deflection only. There is no any calibrated scale.
  - Secondary instruments. Secondary instruments are those, which are calibrated in comparison with some absolute instrument so as to indicate the electrical quantity to be measured with the deflection of needle or pointer of that meter over a calibrated scale.
205. What are the operating principles of electrical measuring instruments?
- Magnetic effect.
  - Electro dynamic effect.
  - Electro magnetic effect.
  - Thermal effect.
  - Chemical effect.
  - Electro static effect.
206. What are the classifications of secondary instruments?
- Indicating instruments.
  - Recording instruments.
  - Integrating instruments.
207. What are the essentials of indicating instrument?
- Deflecting torque or force (effect of electricity).
  - Controlling torque or force (spring control and gravity control).
  - Damping torque or force (air friction, eddy current and fluid friction).
208. What are the possible errors in induction (energy meter) measuring instruments?
- Phase error: Field flux in induction meter does not lag  $90^\circ$  behind the supply voltage due to its resistance. This can be adjusted by copper shading rings, which are placed at the central limb of the shunt magnet.
  - Speed error: An error in speed, which is tested on the non-inductive load, can be eliminated by correctly adjusting the position of the brake magnet.
  - Friction error: It can be reduced very much by providing two copper shading at the both outer limbs.
  - Creeping error: Some time slow, continuous rotation of the disc (rotor) when only the pressure coil is excited, but no current flowing in the circuit (no current in current coil) may happen. It may be caused due to incorrect friction compensator, stray magnetic field, and excess voltage. This can be rectified by drilling two holes in the disc on the opposite sides of the spindle. This causes sufficient distortion of the field to prevent rotation, when one of the holes comes under one of the pole of the shunt magnet.
209. What is illumination?
- The quantity of a light emitted by a lighting source is known as illumination. Heating effect of electric current is used in producing illumination. When a solid or vapour is heated it begins to radiate energy in the surrounding media. Lux is the unit for illumination. Lux is the illumination produced by a uniform source of candle power on the inner surface of a sphere of radius one (1) meter.
210. What are the laws of illumination?
- Illumination 'E' is directly proportional to the luminous intensity 'I' of the source. ie  $E \propto I$ .

- b. Inverse square law: The illumination of the surface is inversely proportional to the square of the distance of the surface from the source. ie  $E \propto 1/d^2$ .
- c. Illumination 'E' is directly proportional to the cosine of angle made by the normal to the illumination surface and the direction of the incident light and is known as lam pod's cosine angle.

211. What are the factors to be considered for correct illumination?

- a. Nature of work.
- b. Determine the foot-candle illumination required after studying the nature of work. Example for precision work – 100 foot candle, for fine engraving – 50 foot candle, for reading, typing, drawing, fine machine works 25 foot candle etc.
- c. Design of apartment using for the proper projection of illumination for better work or purpose.

212. What are the types of lighting?

- a. Direct lighting: light directly comes from the source to the surface.
- b. Indirect lighting: light reflects from the wall, reflector or ceilings etc.
- c. Semi direct lighting: light comes through the shade.

213. What are the properties of good illumination?

- a. It should have sufficient light.
- b. It should not strike the eyes.
- c. It should not produce glares.
- d. Light should be uniform.
- e. It should be of harmonious.
- f. It should be of correct type as needed.
- g. It should have suitable shade and reflector.
- h. Economically productive.

214. What are the sources of light?

- a. Incandescent lamps.
- b. Carbon arc lamps.
- c. Gas discharge lamps.

215. What are the materials used in Neon sign tube lamps for different colours?

Following are the materials used in neon sign tubes for different colours.

For, Red – Neon gas

Reddish orange – Neon gas + Argon gas

Blue – Vapour of mercury.

Golden – Neon gas + Helium gas.

Green – mixture of Neon gas and mercury in yellow glass tube

By depositing fluorescent powder on the inner surface of the tube varying colors in intensity can be made.

*(To be continued)*

*Courtesy: <https://www.scribd.com/document/244623258/Question-and-Answers-Electrical-Maintenance-Unit>*

## SUBSTATION DESIGN / APPLICATION GUIDE – 4

### 3.3.5 Compensation Equipment

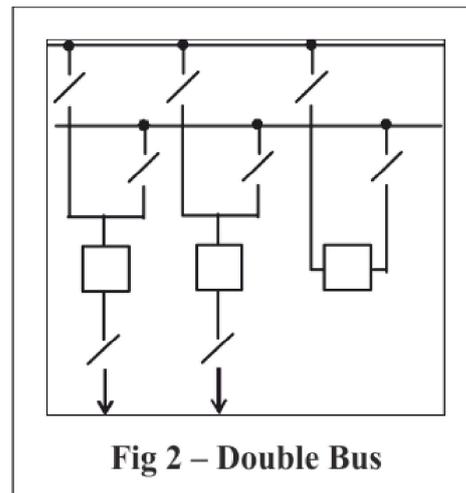
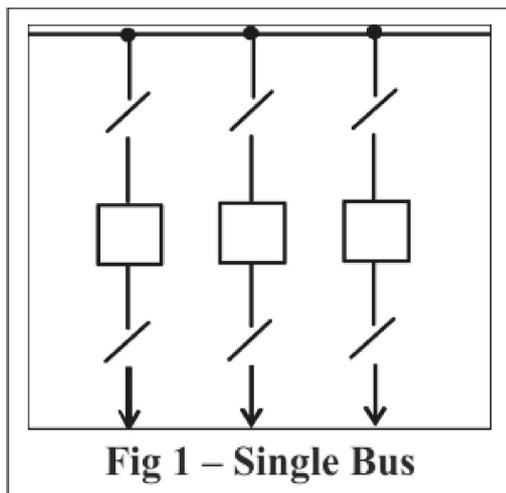
There are several forms of compensative equipment, such as :

- Synchronous Compensators
- Shunt Reactors
- Mechanically Switched Shunt Connected Capacitor Banks (MSC)
- Mechanically Switched Damping Network (MSCDN)
- Series Capacitor Banks
- Static Var Compensators (SVC)

### 3.4 Substation Layout Arrangement

#### 3.4.1 Single Bus

The most simple electrical arrangement which, without a bus section, has poor service continuity, no operational facilities and requires a shut down for any extension. It is more common at the lower voltages especially with metalclad switchgear. When fitted with bus section isolators with or without a bus section circuit breaker, the service continuity and operational facilities improve slightly and extensions are possible with only part shut down. Note that with some circuits (e.g. transformers) the circuit side isolator may be omitted.



#### 3.4.2 Double Bus

A very common arrangement nearly always incorporating a bus coupler circuit and often a bus sectionalising arrangement. It has very good service continuity and operational facilities and can be extended with little or no shutdown depending upon the physical arrangement.

Note that circuit side isolators may sometimes be omitted as for the Single Bus.

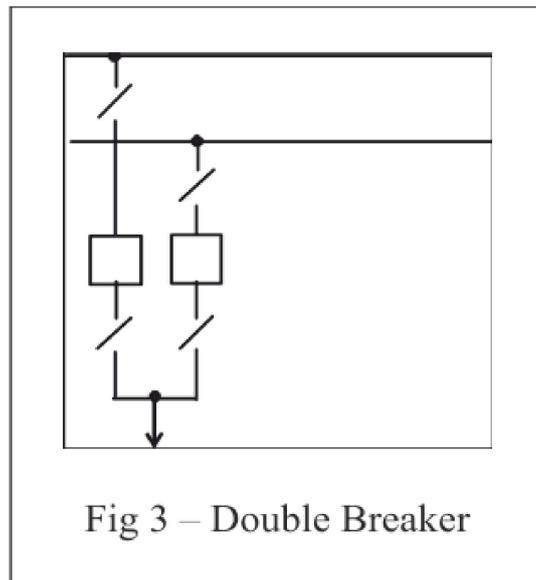
#### 3.4.3 Double Breaker

This is used with double bus arrangements to give improved service continuity. It is normally used only on circuits such as generators where continuity has important economic or operational significance.

A combination of double breaker and single breaker arrangements may be used with a common set of double busbars.

When all circuits have double circuit breakers, a bus coupler circuit breaker is not essential unless it may be required to function as a section circuit breaker. When there is a combination of double breaker and single breaker arrangements, the bus coupler circuit breaker is again not essential as the double breaker can function

as a bus coupler circuit but the increased complexity of the protection, interlocking and operation may make the inclusion of a bus coupler circuit preferable.



### 3.4.4 Bus Section

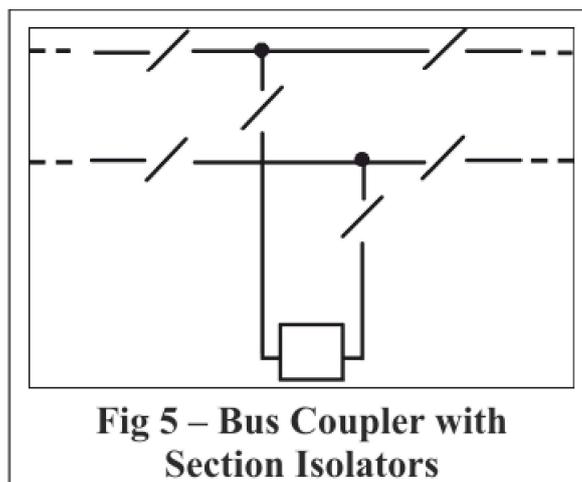
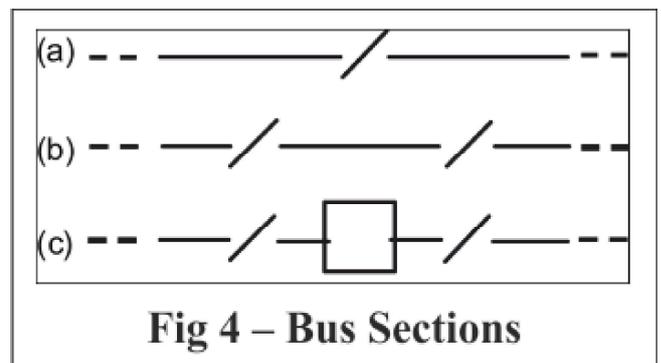
This is applicable to both single and double bus arrangements and in the latter each bus may be treated differently. The service continuity, operational facilities and possibility of extension without shutdown is increased especially when a bus section circuit breaker is included.

The use of two section isolators enables the bus section isolators to be maintained without a complete shutdown.

### 3.4.5 Bus Coupler

Apart from providing improved service continuity and improved operational facilities, it has the particular function of enabling the on-load transfer of circuits from one bus to another. In combination with bus section isolators as in *Figure 5*, it can be used as a bus section to improve the operational facilities.

With by-pass arrangements, it would also function as the “standby” or “transfer” circuit breaker.



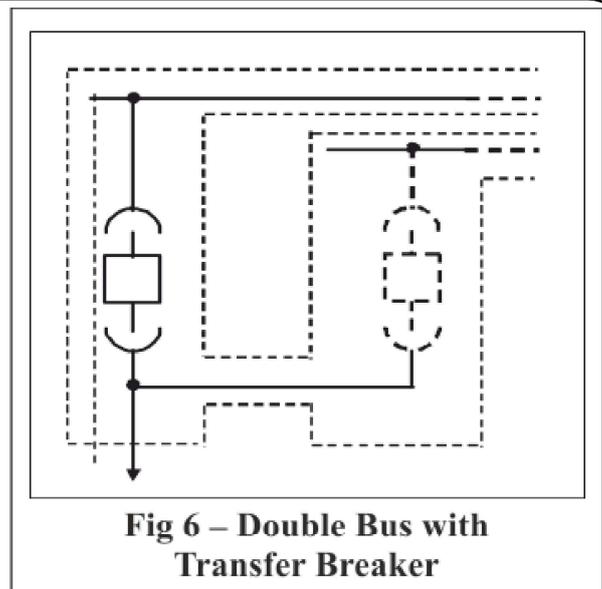
### 3.4.6 Double Bus with Transfer Circuit Breaker

This is an arrangement generally only used with metalclad switchgear. It is a method of achieving a double bus arrangement when a double bus design is not available. In practice there are two switchboards – one for each bus, with the outgoing circuits connected. To transfer, the circuit breaker truck is moved from one switchboard to the corresponding circuit, on the other switchboard. Such an arrangement is “off-load” transfer. Using a spare circuit breaker truck it may be possible to affect an “on-load” transfer.

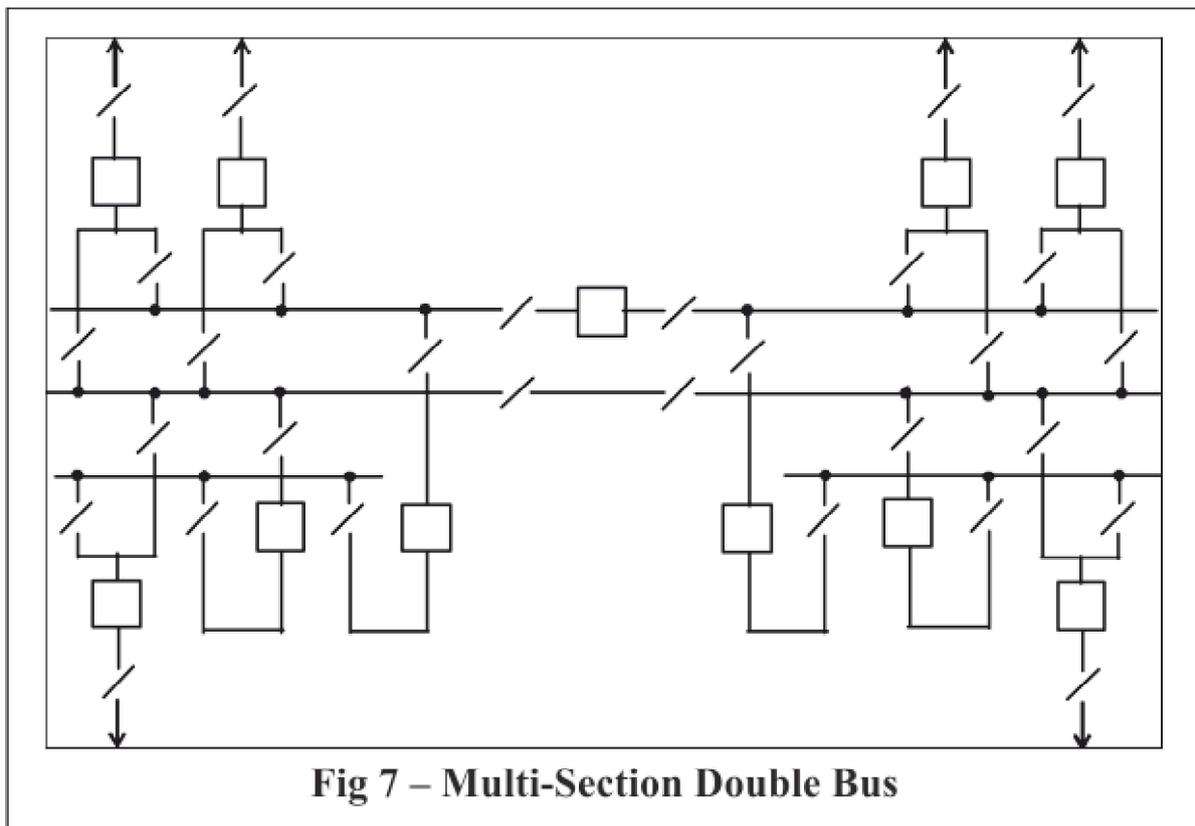
### 3.4.7 Multi-Section Double Bus

This arrangement has been used by the CEGB to obtain maximum security of supply with generating stations, one generator being connected to each of the four sections of main bus. The other circuits are distributed to the best advantage between the sections of main bus. Note that there is only one reserve bus divided into two sections.

Normal operation is with all bus sections closed. With the usual arrangement which is shown in *Figure 7* there are only two bus coupler circuits so that on-load transfer of circuits on buses 2 and 3 is only possible when an appropriate bus section is closed.



**Fig 6 – Double Bus with Transfer Breaker**

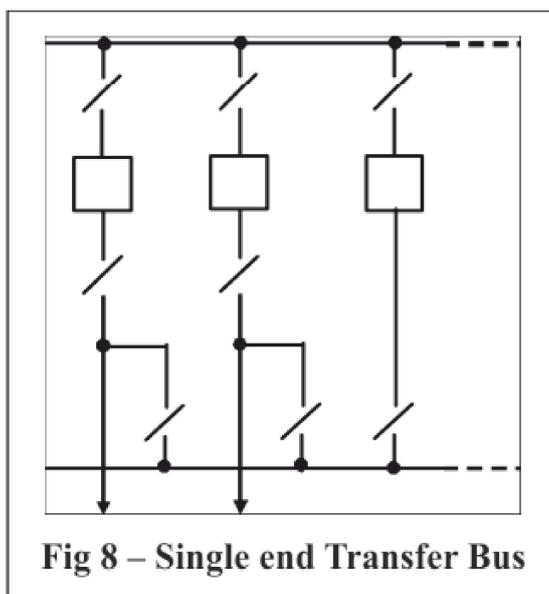


**Fig 7 – Multi-Section Double Bus**

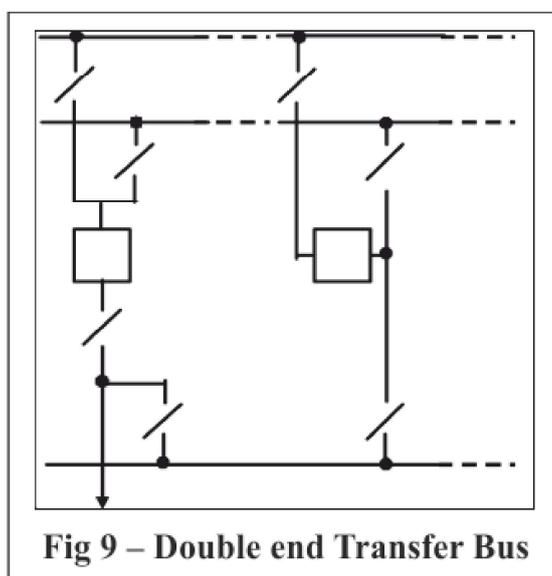
### 3.4.8 Transfer Bus

Sometimes also known as the “Jack Bus”, this is applicable to both single and double bus arrangements and enables a circuit breaker to be taken out of service for maintenance, the circuit then being under the control of a dedicated “transfer” circuit breaker.

Note that only circuit area can be transferred at any one time and the transfer isolators are to be interlocked to ensure this.



**Fig 8 – Single end Transfer Bus**



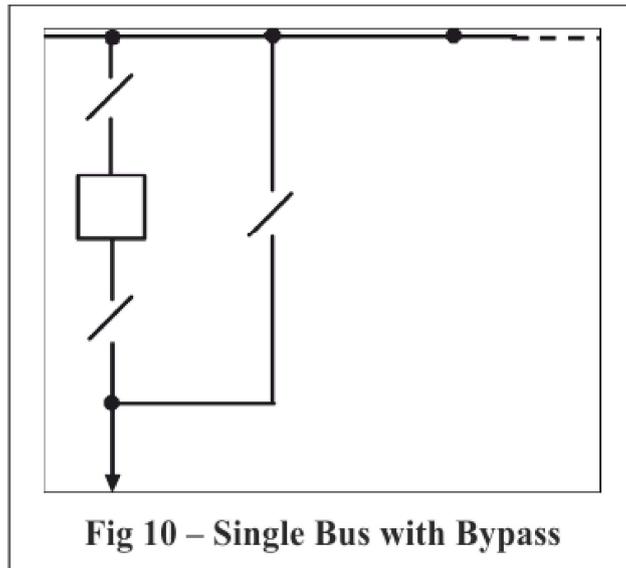
**Fig 9 – Double end Transfer Bus**

### 3.4.9 By-pass

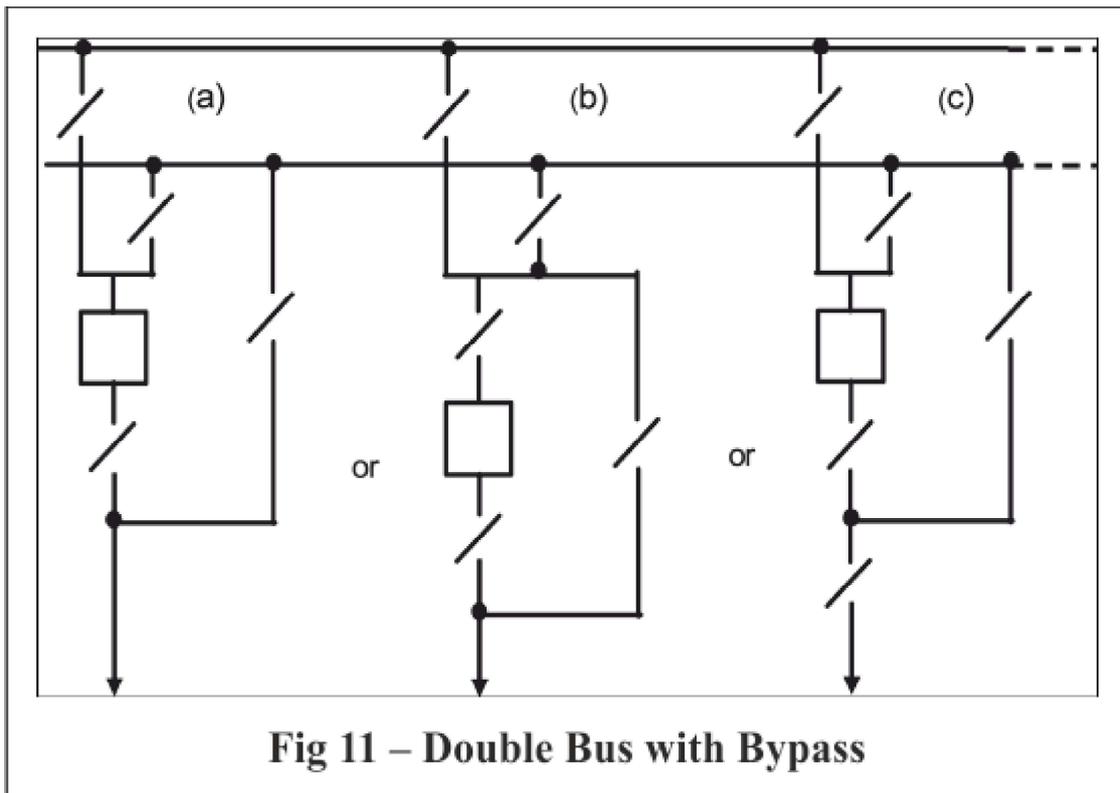
This is an alternative to the transfer bus and is applicable to both single and double bus arrangements although with the single bus arrangements there is no individual protection for the circuit under by-pass and switching is generally only possible by switching several circuits. By-pass enables a circuit to continue in operation whilst the circuit breaker is being maintained. Since modern circuit breakers are much more reliable and require less frequent maintenance, the practice of by-pass is rarely used with modern designs.

In some designs economies are made by replacing one or more of the isolators with removable connections but this requires a temporary shutdown of the circuit. The physical arrangement of the substation equipment has to be designed that such connections can be removed (or added) without undue difficulty and that all necessary safety clearances can be obtained.

With the arrangements shown in *Figures 10, 11(a) and 11(b)*, the circuit current transformers are also by-passed with the circuit breaker and the circuit protection is then completely provided by the other current transformers and relays.



(In the case of the double bus, by the bus coupler circuit). *Figure 11(c)* shows an arrangement using a further isolator where the current transformers are not by-passed and the circuit protection remains in service with the tripping transferred to the bus coupler circuit breaker. (Note that any bus coupler protection would still be capable of operating).



*(To be Continued)*

*Courtesy: V Ayadurai Bsc, C.Eng, FIEE  
Engineering Expert*

## TATA POWER SOLAR AWARDED 100 MW SOLAR PLUS 120 MWH BESS FROM SECI

Tata Power Solar Systems Limited (Tata Power Solar), India's largest integrated solar company and a wholly owned subsidiary of Tata Power, has received Letter of Award (LoA) from Solar Energy Corporation of India Ltd. (SECI) to build 100 MW EPC Solar project along with 120 MWh Utility Scale Battery Energy Storage System (BESS). The total contract value of the project is approximately ₹945 crore. The project will be executed within 18 months.



The Utility Scale EPC order book of Tata Power Solar now stands at ~4.4 GW (DC) capacity with an approximate value of ₹9,000 crore (without GST), thereby strengthening its position as India's leading Solar EPC player.

SECI project sites are located in Chhattisgarh. The order scope includes engineering, design, supply, construction, erection, testing, O&M and commissioning of the projects.

Tata Power's vision has always been to look forward to adoption of new technologies with innovation. With this win, the Company has strengthened its diversified offerings with BESS within the renewable segment.

Speaking on the achievement, Dr. Praveer Sinha, CEO & MD, Tata Power said, "We are glad to receive this prestigious order from SECI to build Solar EPC projects along with the India's largest Utility Scale BESS project. This is the second grid-scale solar plant with BESS and is recognition of Tata Power Solar's pioneering work in project execution capabilities in the solar energy domain."

Over the years, Tata Power Solar has been one of India's leading solar rooftop EPC player with compelling economics, especially for the commercial and industrial segment. Tata Power Solar comes with a successful background of executing large projects, to name a few 80 MW NTPC Jetsar, 50 MW Kasargod at Kerala, 100 MW GIPCL Raghnesda, 100 MW TPREL Raghnesda, 30 MW GSECL. Another innovative Solar project of 50 MW with BESS of 50 MWh battery storage is under execution at Leh.

## BIO CNG OR CBG (COMPRESSED BIO GAS) PROGRAM OF INDIA

### Successful commercialization of “Liquification of CBG” (Bio LNG) in Europe.

India has launched and progressing fast with CBG Program, initially with a target of 15 Million Tons per annum, to be taken forward in the near future to around 60 Million Tons per Annum. Liquification of the CBG will be a significant step forward as it will facilitate easy transportation of the Gas as it is being done today for LPG Gas all over the country. In the context of Global concerns and plans for “Net 0 Emission by 2050/ 2070 etc, it is important that the Technologies are easily accessible to all countries, particularly for India as it will help gallop with this important program to replace fossils.

### Gasum completes first truck-to-ship bioLNG bunker in Norway

October 29, 2021

Finland-headed gas and energy company Gasum Oy has completed the bunkering of liquefied biomethane (LBG or bioLNG) for the first time to an offshore supply vessel in Norway. The fuel was delivered to Lundin Energy Norway’s Island Crusader vessel.

*Gasum Oy has completed a truck-to-ship bunker of liquefied biomethane (LBG or bioLNG) for the first time to an offshore supply vessel in Norway. The fuel was delivered to Lundin Energy Norway’s Island Crusader (photo courtesy Gasum).*



Lundin Energy Norway is a leading oil and gas company that aims to reach carbon neutrality across its operations by 2023. Battery hybridization of all supply and stand-by vessels on fixed contracts is part of its decarbonization strategy.

The truck-to-ship bunkering was performed to Lundin Energy Norway’s supply vessel Island Crusader at the Risavika harbour, close to Stavanger. The Island Crusader is a battery hybrid that runs on liquefied gas.

According to Gasum, LBG aka bioLNG is currently the cleanest maritime fuel available. It can reduce fuel emissions during its lifecycle by up to 90 percent.

BioLNG is also interchangeable and blendable with liquefied natural gas (LNG) that is becoming used more frequently as a fuel in maritime operations. Using LNG reduces greenhouse gas (GHG) emissions by up to 21 percent compared to conventional fossil marine fuels.

We are very happy to support Lundin Energy Norway on its journey towards carbon-neutral operations. Biogas is a way to significantly reduce the maritime sector’s emissions and it is available already today which makes it a viable option for companies, said Gunnar Helmen, Gasum.

The Norwegian oil and gas business is facing stricter emission targets going forward. BioLNG as offshore vessel fuel is an efficient solution to meet these targets. One reason is that a large number of these vessels are already running on LNG.

The biogas is produced from organic waste and contributes to the circular economy. Gasum owns and operates a number of biogas plants throughout the Nordics, and is aiming for increased biogas production. It also has biogas upgrading to biomethane, and biomethane liquefaction plants.

Gasum’s goal is to reach cumulative carbon emission reductions of million tonnes by increasing its biogas production. By 2025 the energy company intends to make 4 TWh of biogas available on the market from the company’s own production and that of its certified European partners.

Together with supporting politics we can increase the Norwegian biogas production significantly and contribute in making waste to energy pushing for the green shift, and we can do it today, Gunnar Helmen concluded.

# FIRE EXTINGUISHER TYPES

In the hands of a trained person, portable fire extinguishers are great tools to protect people and property from fire during early stages. When using an extinguisher or selecting an extinguisher to install, it's important to know the characteristics of different fire extinguishers. This blog will address the different types of fire extinguishers by breaking them down by their extinguishing agent, which is the material inside the extinguisher that gets applied to the fire.

## Class of Fire Description

Class A Fires	Fires in ordinary combustible materials, such as wood, cloth, paper, rubber, and many plastics.
Class B Fires	Fires in flammable liquids, combustible liquids, petroleum greases, tars, oils, oil-based paints, solvents, lacquers, alcohols, and flammable gases.
Class C Fires	Fires that involve energized electrical equipment.
Class D Fires	Fires in combustible metals, such as magnesium, titanium, zirconium, sodium, lithium, and potassium.
Class K Fires	Fires in cooking appliances that involve combustible cooking media (vegetable or animal oils and fats).

## Water

Water is the primary liquid used in these extinguishers, although sometimes other additives are also included. A drawback for pure water fire extinguishers is that it is not suitable for use in freezing conditions since the water inside will freeze and render the extinguisher unusable. Certain types of water fire extinguishers contain antifreeze which will allow the extinguisher to be used in freezing conditions. Water type fire extinguishers can also sometimes contain wetting agents which are designed to help increase its effectiveness against fire. These extinguishers are intended primarily for use on Class A fires.

Water mist extinguishers are a type of water fire extinguisher that uses distilled water and discharges it as a fine spray instead of a solid stream. Water mist extinguishers are used where contaminants in unregulated water sources can cause excessive damage to personnel or equipment. Typical applications include operating rooms, museums, and book collections.

## Film-forming foam type

AFFF (aqueous film-forming foam) and FFFP (film-forming fluoroprotein) fire extinguishers are rated for use on both Class A and Class B fires. As the name implies, they discharge a foam material rather than a liquid or powder. They are not suitable for use in freezing temperatures. An advantage of this type of extinguisher when used on Class B flammable liquid fires of appreciable depth is the ability of the agent to float on and secure the liquid surface, which helps to prevent reignition.

## Carbon Dioxide type

The principal advantage of Carbon Dioxide (CO<sub>2</sub>) fire extinguishers is that the agent does not leave a residue after use. This can be a significant factor where protection is needed for delicate and costly electronic equipment. Other typical applications are food preparation areas, laboratories, and printing or duplicating areas. Carbon dioxide extinguishers are listed for use on Class B and Class C fires. Because the agent is discharged in the form of a gas/snow cloud, it has a relatively short range of 3 ft to 8 ft (1 m to 2.4 m). This type of fire extinguisher is not recommended for outdoor use where windy conditions prevail or for indoor use in locations that are subject to strong air currents, because the agent can rapidly dissipate and prevent extinguishment. The

concentration needed for fire extinguishment reduces the amount of oxygen in the vicinity of the fire and should be used with caution when discharged in confined spaces.

## **Halogenated agent types**

### **Halon**

The bromochlorodifluoromethane (Halon 1211) fire extinguisher has an agent that is similar to carbon dioxide in that it is suitable for cold weather installation and leaves no residue. It is important to note that the production of Halon has been phased out because of the environmental damage it causes to the earth's ozone. Some larger models of Halon 1211 fire extinguishers are listed for use on Class A as well as Class B and Class C fires. Compared to carbon dioxide on a weight-of-agent basis, bromochlorodifluoromethane (Halon 1211) is at least twice as effective. When discharged, the agent is in the combined form of a gas/mist with about twice the range of carbon dioxide. To some extent, windy conditions or strong air currents could make extinguishment difficult by causing the rapid dispersal of the agent.

### **Halon Alternative Clean Agents**

There are several clean agents that are similar to halon agents in that they are nonconductive, noncorrosive, and evaporate after use, leaving no residue. Larger models of these fire extinguishers are listed for Class A as well as Class B and Class C fires, which makes them quite suitable for use on fires in electronic equipment. When discharged, these agents are in the combined form of a gas/mist or a liquid, which rapidly evaporates after discharge with about twice the range of carbon dioxide. To some extent, windy conditions or strong air currents could make extinguishing difficult by causing a rapid dispersal of agent. Clean agent type extinguishers don't have a detrimental effect on the earth's ozone so these are more widely available than Halon type extinguishers.

## **Dry chemical types**

### **Ordinary Dry Chemical**

The fire extinguishing agent used in these devices is a powder composed of very small particulates. Types of agents available include sodium bicarbonate base and potassium bicarbonate base. Dry chemical type extinguishers have special treatments that ensure proper flow capabilities by providing resistance to packing and moisture absorption (caking).

### **Multipurpose Dry Chemical**

Fire extinguishers of this type contain an ammonium phosphate base agent. Multipurpose agents are used in exactly the same manner as ordinary dry chemical agents on Class B fires. For use on Class A fires, the multipurpose agent has the additional characteristic of softening and sticking when in contact with hot surfaces. In this way, it adheres to burning materials and forms a coating that smothers and isolates the fuel from air. The agent itself has little cooling effect, and, because of its surface coating characteristic, it cannot penetrate below the burning surface. For this reason, extinguishment of deep-seated fires might not be accomplished unless the agent is discharged below the surface or the material is broken apart and spread out.

### **Wet chemical**

The extinguishing agent can be comprised of, but is not limited to, solutions of water and potassium acetate, potassium carbonate, potassium citrate, or a combination of these chemicals (which are conductors of electricity). The liquid agent typically has a pH of 9.0 or less. On Class A fires, the agent works as a coolant. On Class K fires (cooking oil fires), the agent forms a foam blanket to prevent reignition. The water content of the agent aids in cooling and reducing the temperature of the hot oils and fats below their autoignition point. The agent, when discharged as a fine spray directly at cooking appliances, reduces the possibility of splashing hot grease

and does not present a shock hazard to the operator. Wet chemical extinguishers also offer improved visibility during firefighting as well as minimizing cleanup afterward.

### Dry powder types

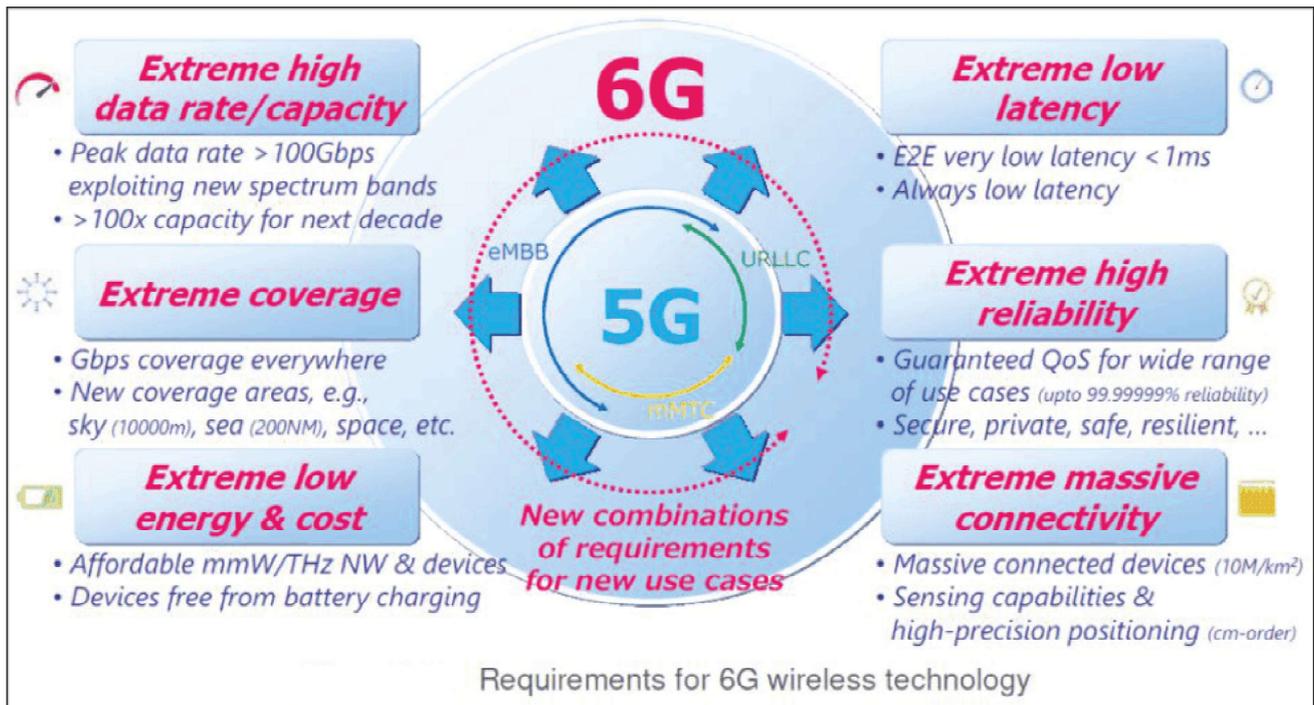
These fire extinguishers and agents are intended for use on Class D fires and specific metals, following special techniques and manufacturer’s recommendations for use. The extinguishing agent can be applied from a fire extinguisher or by scoop and shovel. Using a scoop or shovel is often referred to as a hand propelled fire extinguisher.

Type Extinguisher Type	Fire Type						
	Class A Organic Materials (e.g Paper & Coal)	Class B Flammable Liquids (e.g Petrol & Paint)	Class C Flammable Gases (e.g Butane & Methane)	Class D Flammable Metals (e.g Lithium & Magnesium)	Electrical Equipment (e.g Computers & Servers)	Class F Cooking Oils (e.g Olive Oil & Fat)	Businesses that may need this type of Extinguisher
Water	✓	✗	✗	✗	✗	✗	- Schools - Hospitals - Offices - Shops
Foam	✓	✓	✗	✗	✗	✗	- Apartments - Hospitals - Offices - Shops
Dry Powder	✓	✓	✓	✓	✓	✗	- Garages - Welding - Boiler Rooms - LPG Plants
CO2	✗	✓	✗	✗	✓	✗	- Server Rooms - Offices
Wet Chemical	✓	✗	✗	✗	✗	✓	- Kitchens - Canteens



# 6G IS YEARS AWAY, BUT THE POWER STRUGGLES HAVE ALREADY BEGUN

WHEN WIRELESS RESEARCHERS or telecom companies talk about future sixth-generation (6G) networks, they're talking mostly about their best guesses and wish lists. There are as yet no widely agreed upon technical standards outlining 6G's frequencies, signal modulations, and waveforms. And yet the economic and political forces that will define 6G are already in play. And here's the biggest wrinkle: Because there are no major U.S. manufacturers of cellular infrastructure equipment, the United States may not have the superpowers it thinks it does in shaping the future course of wireless communications.



While many U.S. tech giants will surely be involved in 6G standards development, none of those companies make the equipment that will comprise the network. Companies like Ericsson (Sweden), Nokia (Finland), Samsung (South Korea), and Huawei (China) build the radio units, baseband units, and other hardware and software that go into cell towers and the wired networks that connect them.

As one example, equipment manufacturers (such as China's Huawei and ZTE) will probably push for standards that prioritize the distance a signal can travel, while minimizing the interference it experiences along the way. Meanwhile, device makers (like U.S. heavyweights Apple and Alphabet) will have more stake in standardizing signal modulations that drain their gadgets' batteries the least.

6G is—and isn't yet—around the corner. When the Global Communications Conference (Globecom) begins in Madrid this December, attending researchers and telecom executives will find it features no fewer than five workshops devoted to 6G development. Compare that to the 2020 iteration of the IEEE Communication Society's annual conference, which—pandemic notwithstanding—included nothing 6G related beyond a 4-hour summit on the topic. And if you step back one year further to Globecom 2019, you'll find that 6G was limited to a single technical talk.

Cellular standards are developed and overseen by a global cellular industry consortium, the 3rd Generation Partnership Project (3GPP). Past wireless generations coalesced around universally agreed-upon standards relatively smoothly. But early research into 6G is emerging in a more tense geopolitical environment, and the quibbles that arose during 5G's standardization could blossom into more serious disagreements this time around.

To date, 6G has been discussed in terms of applications (including autonomous vehicles and holographic displays) and research interests—such as terahertz waves and spectrum sharing. So for the next few years, whenever a so-called “6G satellite” is launched, for example, take it with a grain of salt: It just means someone is testing technologies that may make their way into the 6G standards down the line.

But such tests, although easily overhyped and used to set precedents and score points, are still important. The reason each generation of wireless—2G, 3G, 4G, and now 5G—has been so successful is because each has been defined by standards that have been universally implemented. In other words, a network operator in the United States like AT&T can buy equipment from Swedish manufacturer Ericsson to build its cellular network, and everything will function with phones made in China because they’re drawing on the same set of agreed-upon standards.

In 2016, as the standards were being sorted out for 5G, a clash emerged in trying to decide what error-correcting technique would be used for wireless signals. Qualcomm, based in San Diego, and other companies pushed for low-density parity checks (LDPC), which had been first described decades earlier but had yet to materialize commercially. Huawei, backed by other Chinese companies, pushed for a new technique in which it had invested a significant amount of time and energy that it called polar codes. A deadlock at the 3GPP meeting that November resulted in a split standard: LDPC would be used for radio channels that send user data and polar codes for channels that coordinated those user-data channels.

That Huawei managed to take polar codes from a relatively unknown mathematical theory and almost single-handedly develop it into a key component of 5G led to some proclamations that the company (and by extension, China) was winning the battle for 5G development. The implicit losers were Europe and the United States. The incident made at least one thing abundantly clear: There is a lot of money, prestige, and influence in the offing for a company that gets the tech it’s been championing into the standards.

In May 2019, the U.S. Bureau of Industry and Security added Huawei to its Entity List—which places requirements on, or prohibits, importing and exporting items. Sources that IEEE Spectrum spoke to noted how the move increased tensions in the wireless industry, echoing concerns from 2019. “We are already seeing the balkanization of technology in many domains. If this trend continues, companies will have to create different products for different markets, leading to even further divergence,” Zvika Krieger, the head of technology policy at the World Economic Forum told MIT Technology Review at the time of the ban. The move curtailed the success Huawei originally saw from its 5G standards wins, with the rotating chairman, Eric Xu, recently saying that the company’s cellphone revenue will drop by US \$30 billion to \$40 billion this year from a reported \$136.7 billion in 2020.

As fundamental research continues into what technologies and techniques will be implemented in 6G, it’s too early to say what the next generation’s version of polar codes will be, if any. But already, different priorities are emerging in the values that companies and governments in different parts of the world want to see enshrined in any standards to come.

So how will concepts like privacy, security, or sustainability be embedded in 6G—if at all? For instance, one future version of 6G could include differential privacy, in which data-set patterns are shared without sharing individual data points. Or it could include federated learning, a machine learning technique that instead of being trained on a centralized data set uses one scattered across multiple locations—thereby effectively anonymizing information that malicious actors in a network might otherwise put to nefarious purposes. These techniques are already being implemented in 5G networks by researchers, but integrating them into 6G standards would give them more weight.

The Washington, D.C.–based Alliance for Telecommunications Industry Solutions launched the Next G Alliance in October 2020 to strengthen U.S. technological leadership in 6G over the course of the next decade. Mike Nawrocki, the alliance’s managing director, says the alliance is taking a “holistic” approach to 6G’s development. “We’re really trying to look at it from the perspective of what are some of the big societal drivers that we would

envision for the end of the decade,” Nawrocki says, citing as one example the need to connect industries previously unconcerned with the wireless industry such as health care and agriculture.

If different regions—the United States, Europe, China, Japan, South Korea, and so on—find themselves at loggerheads about how to define certain standards or support incompatible policies about the implementations or applications of 6G networks, global standards could ultimately, in a worst-case scenario, disintegrate. Different countries could decide it’s easier to go it alone and develop their own 6G technologies without global cooperation. This would result in balkanized wireless technologies around the world. Smartphone users in China might find their phones unable to connect with any other wireless network outside their country’s borders. Or, for instance, AT&T might, in such a scenario, no longer buy equipment from Nokia because it’s incompatible with AT&T ‘s network operations.

Although that’s a dire outcome, the industry consensus is that it’s not likely yet—but certainly more plausible than for any other wireless generation.

## BOUNCE EV

Bengaluru-based EV start-up Bounce has launched its first electric scooter in India today, the Infinity E1. If the scooter looks familiar to you it’s because Bounce has bought out the now-defunct 22Kymco’s operation and this scooter is essentially the 22Kymco i-Flow that was launched in June 2019.

### **Bounce Infinity E1 battery swapping: how does it work?**

The Infinity E1 will be offered with a unique ‘Battery as a service’ option, where customers can either buy the scooter with the battery and the charger, or even avail the battery pack on a rental basis. The Bounce Infinity E1 has been priced at Rs 68,999 with the battery and charger, while it costs Rs 45,099 without the battery (both prices, ex-showroom, Delhi). The company has not revealed what the cost of its battery subscription programme will be.



For customers who buy the Infinity E1 without the battery pack, Bounce says that the batteries can be swapped for fully charged units through a dedicated battery swapping network. The company says it aims to have the world's largest and densest battery-swapping platform with a swapping facility at every 1km distance. The company claims this will bring down running costs of the scooter by as much as 40 percent, as compared to conventional scooters. The Infinity E1 is the first electric scooter in India with battery swapping feature.

### **Bounce Infinity E1: technical details**

The Infinity E1 is powered by a 2kWh lithium-ion battery pack that provides a certified range of 85km per charge. While the company hasn't quoted a power figure for the electric scooter, torque output for E1 stands at 83Nm. Bounce claims the Infinity E1 can sprint from 0 to 40kph in 8sec and has a top-speed of 65kph.

The battery pack can be topped up in about 4 to 5 hours by connecting to any regular electric socket. The scooter also comes with two riding modes – Power and Eco. In terms of underpinnings, the Infinity E1 is built on a tubular frame and features hydraulic telescopic front suspension and twin shock absorbers at the rear. It also gets disc brakes at both ends with Electronic Braking system (EBS) and also gets regenerative braking technology.



### **Bounce Infinity E1: design and features**

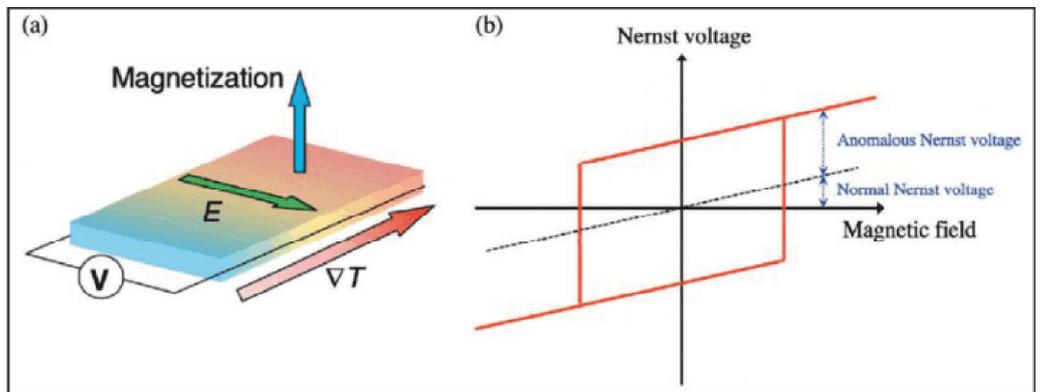
In terms of design, the Infinity E1 looks like a fairly conventional scooter, although its simplicity has a certain elegance to it. Some of the highlights include round LED projector headlamps with smart detailing, flush-fitting rear foot pegs, and stylish alloy wheels. The Infinity E1 will be available with a choice of five colours – Sporty Red, Sparkle Black, Pearl White, Desat Silver and Comed Grey – in either glossy or matte finish.

As for its features, the Bounce gets a digital instrument cluster, a reverse mode, cruise control and tow alert. It also gets a unique drag mode that allows the scooter to move along at walking speed, in case it has a puncture and you want to push it along. Bounce has provided a smart app with the Infinity E1 that can be connected via Bluetooth and used for geofencing, track the scooter remotely, check charging status and more.

***The ultimate test of man's conscience may be his willingness to sacrifice something today for future generations whose words of thanks will not be heard. – GAYLORD NELSON***

# A NEW WAY TO GENERATE ELECTRICITY FROM WASTE HEAT: USING AN ANTIFERROMAGNET FOR SOLID DEVICES

Forcing electrons to flow perpendicularly to a heat flow requires an external magnetic field – this is known as the Nernst effect. In a permanently magnetized material (a ferromagnet), an anomalous Nernst effect (ANE) exists that can generate electricity from heat even without a



magnetic field. The anomalous Nernst effect scales with the magnetic moment of the ferromagnet. An antiferromagnet, with two compensating magnetic sublattices shows no external magnetic moment and no measurable external magnetic field and therefore should not exhibit any ANE. However, we have recently understood that by the new concept of topology can be applied to achieve large Nernst effects in magnets. In particular, we have learned that the quantity known as the Berry phase is related to the ANE and can greatly increase it. However, the ANE in antiferromagnets is still largely unexplored, in part because the ANE was not thought to exist. Remarkably, a joint research team from the Max Planck Institute for Chemical Physics of Solids in Dresden, Germany, together with collaborators at the Ohio State University and the University of Cincinnati, has found a large anomalous Nernst effect, larger than is known in almost all ferromagnets in  $\text{YbMnBi}_2$ , an antiferromagnet.

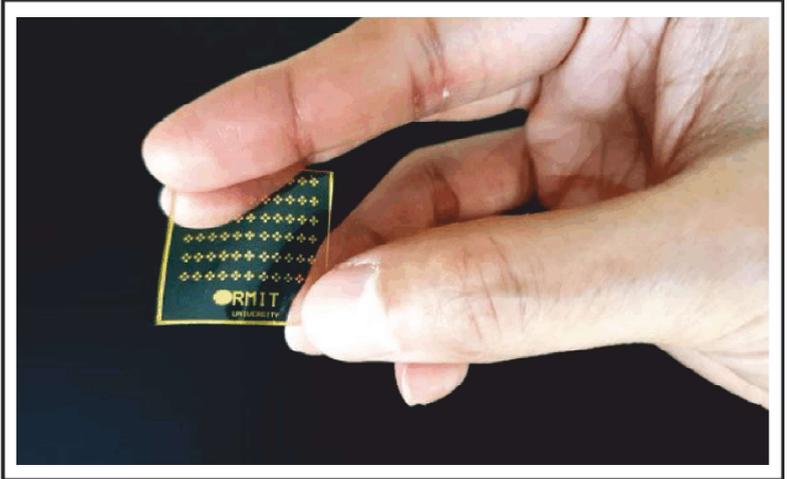
The ANE that has been observed is likely a result of topology, the high spin-orbit coupling, and the complex and not fully compensated magnetic structure of  $\text{YbMnBi}_2$ . The canted spin structure in  $\text{YbMnBi}_2$  breaks time reversal symmetry and provides a non-zero Berry curvature. At the same time, the large spin-orbit coupling of the heavy bismuth element helps to produce a large extrinsic contribution. Based on this recipe, a certain class of antiferromagnets with a non-collinear spin structure and with large spin-orbit coupling can exhibit a large anomalous Nernst effect. The researchers were surprised when they observed such a large ANE in  $\text{YbMnBi}_2$ , reaching 6 mV/K, which is a record value for antiferromagnets and as high as those values previously observed for the best ferromagnets.

For practical applications, one could use this new phenomenon to make simple energy converters: a transverse thermoelectric device where the voltage is generated perpendicular to the heat flow. The device consists of only one block of material. The commercially available thermoelectric generators based on the Seebeck effect are complex assemblies built from small blocks of n- and p-type semiconductor materials. Unlike ferromagnets, which often suffer from low carrier mobility, antiferromagnets can also exhibit higher mobilities and therefore show better electrical conductivity. Together with low thermal conductivity, an anomalous thermoelectric figure of merit (zT) is achieved in  $\text{YbMnBi}_2$ , which is an order of magnitude higher than that of all known ferromagnets.

“Although the ANE value is surprisingly large and the zT value is much higher than that of ferromagnets, the overall thermoelectric performance still needs to be improved for practical applications,” says Yu Pan, group leader in the department of Solid State Chemistry at the MPI CPfS in Dresden. She continues, “Nevertheless, this study shows the great potential of antiferromagnets for thermoelectric applications, as they have much better performance than ferromagnets. We believe our work is just the beginning of the discovery of even more interesting thermoelectric materials in the future.”

## NEWLY-DEVELOPED ELECTRONIC ARTIFICIAL SKIN CAN SENSE TOUCH, PAIN AND HEAT

Skin is the largest human sensory organ covering the entire body. Every region of the skin is full of sensors, which detect external stimuli and actively measure the level of such stimuli. Sensory skin feedback is indicative of health. For instance, pin pricks are used to study the response of a nervous system to evaluate degree of paralysis from nerve damage. Artificial skin receptors that demonstrate such feedback ability are integral to advancements in healthcare and intelligent robotics. Such receptors can replace damaged receptors, augment sensation of specific stimuli, or serve as the feedback mechanism for human-machine or machine-machine interfaces.



“Our pain-sensing prototype is a significant advance towards next-generation biomedical technologies and intelligent robotics,” said co-lead author Professor Madhu Bhaskaran, a researcher in the Functional Materials and Microsystems Research Group and the Micro Nano Research Facility at RMIT University. “Skin is our body’s largest sensory organ, with complex features designed to send rapid-fire warning signals when anything hurts.” “We’re sensing things all the time through the skin but our pain response only kicks in at a certain point, like when we touch something too hot or too sharp.”

“No electronic technologies have been able to realistically mimic that very human feeling of pain — until now.” “Our artificial skin reacts instantly when pressure, heat or cold reach a painful threshold.” “It’s a critical step forward in the future development of the sophisticated feedback systems that we need to deliver truly smart prosthetics and intelligent robotics.” Professor Bhaskaran and her colleagues used three technologies in their research:

- (i) stretchable electronics: combining oxide materials with biocompatible silicone to deliver transparent, unbreakable and wearable electronics as thin as a sticker;
- (ii) temperature-reactive coatings: self-modifying coatings 1,000 times thinner than a human hair based on a material that transforms in response to heat;
- (iii) brain-mimicking memory: electronic memory cells that imitate the way the brain uses long-term memory to recall and retain previous information.

The pressure sensor prototype combines stretchable electronics and long-term memory cells, the heat sensor brings together temperature-reactive coatings and memory, while the pain sensor integrates all three technologies. “The memory cells in each prototype were responsible for triggering a response when the pressure, heat or pain reached a set threshold,” said first author Md. Ataur Rahman, also from the Functional Materials and Microsystems Research Group and the Micro Nano Research Facility at RMIT University.

“We’ve essentially created the first electronic somatosensors — replicating the key features of the body’s complex system of neurons, neural pathways and receptors that drive our perception of sensory stimuli.” “While some existing technologies have used electrical signals to mimic different levels of pain, these new devices can react to real mechanical pressure, temperature and pain, and deliver the right electronic response.” “It means our artificial skin knows the difference between gently touching a pin with your finger or accidentally stabbing yourself with it — a critical distinction that has never been achieved before electronically.”

The team’s paper was published in the journal *Advanced Intelligent Systems*.

## E-BIKE REVOLUTION

**The World's Most Popular EVs Aren't Cars, Trucks, or Motorcycles The pandemic has helped transform the e-bike into a juggernaut**

Electric bicycles, better known as e-bikes, have moved from novelty to mainstream with breathtaking speed. They've been a boon to hard-working delivery persons during the pandemic (and their impatient customers), and commuters who don't care to be a sweaty mess when they arrive. And while the scoffing tends to center around the "purity" of cycling—the idea that e-bike riders are somehow lazy cheaters—that electric assist is actually luring people off the couch for healthy exercise. That's especially welcome for older or out-of-practice riders (which describes a whole lot of folks) who might otherwise avoid cycling entirely, put off by daunting hills or longer distances.



While powerful "Class 3" models especially are trying the patience of pedestrians in crowded cities like New York, with blazing assisted speeds approaching 30 mph, e-bikes are now front-and-center in discussions of future urban mobility. They're a way to potentially free up precious street space, provide alternatives to automobiles and reduce energy consumption and harmful emissions. California, through its powerful Air Resources Board, recently allocated \$10 million in rebates for e-bike buyers, a smaller-scale version of state or federal tax breaks for EV car buyers. The possibilities are fueling cool tech ideas, from covered, rain-proof cargo bikes; to pavement-embedded wireless chargers and automated stabilization systems to help senior riders. CityQ is taking pre-orders for a four-wheeled cargo "bike" that it touts as cycling "with a Tesla feeling."

### Pedal to the Metal

The tech behind e-bikes falls into two simpler categories, even if the choice between them isn't as simple. Hub motors integrate a motor directly in the wheel center (either front or rear wheel), in an enclosed system that's independent from the bike chain and pedal drive. There are two main types: Geared hub motors incorporate internal planetary gears for reduction, allowing the motor to operate efficiently at high rpm while the bike wheel spins at a lower speed. Gearless hub motors directly link the motor's stator to the bike axle. That reduces a key point of weakness—the toothed gears.

Aside from bearings, there are no moving parts, nothing to wear out. Hub motors are relatively affordable, low-maintenance, mass produced by the millions. A do-it-yourselfer can find entire, 800- to 1,000-watt hub motor kits for around \$200, where mid-drive power can cost three to five times as much. Hub motors add no extra stress or wear to a chain or shifters, and offer another advantage versus a mid-drive set-up: If a hub motor conks out, you can still pedal home, and vice-versa; if a chain or pedal breaks, a rider can keep moving under electric power. The downsides? Nearly every hub motor has a single gear ratio; fine for the flats, not so good for hill climbs, where the motor can't match a mid-drive unit for a robust shove against gravity, and may even overheat on long ascents. Hub motors can also make a bike feel unbalanced and awkward to steer—like it's being pushed or pulled rather than pedaled. Tire changes are more difficult because of the wheel-mounted motor.

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around the “purity” of cycling—the idea that e-bike riders are somehow lazy cheaters—that electric assist is actually luring people off the couch for healthy exercise. That’s especially welcome for older or out-of-practice riders (which describes a whole lot of folks) who might otherwise avoid cycling entirely, put off by daunting hills or longer distances.

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rain-proof cargo bikes; to pavement-embedded wireless chargers and automated stabilization systems to help senior riders. CityQ is taking pre-orders for a four-wheeled cargo “bike” that it touts as cycling “with a Tesla feeling.”

In 2020, according to one estimate, 500,000 e-bikes were sold in the U.S. alone—compared to 210,000 plug-in cars.

According to market research company NPD Group, the pandemic helped increase e-bike sales by 145 percent from 2019 to 2020, more than double the growth of traditional bikes. Exact figures on industry sales are hard to pin down; yet The New York Times quoted experts saying Americans bought roughly 500,000 e-bikes in 2020, compared to about 210,000 plug-in automobiles.

Industry analysts expect that uptick in adoption to continue. A report by the Business Research Company shows the global e-bike market growing from \$32.5 billion last year to \$53 billion by 2025, for annual compound growth of 9.9 percent. Even in bike-saturated Europe, e-bike sales jumped by 23 percent in 2019. And Deloitte expects 300 million e-bikes on the world’s streets by 2023. That’s a lot of bikes, batteries and saved muscle power from thankful riders. If you’re not up to speed on e-bikes, or you’re curious about taking one for a spin, here’s a look at some of the techs, terms and players:

“Mid-drive” bikes, in contrast, locate the motor inside the frame and between pedals at the bottom bracket. Motor power is transferred through the chain drive to the rear wheel. As with EVs, those motors are growing lighter, stronger, quieter and more affordable. The biggest edge—with a parallel downside—is sending power through a traditional chain and gear seat: The motor can deliver major torque up a steep hill or from a standstill, in a lower gear and higher rpm, just as your pedals do.

That energizer-style power keeps going and going, even on long climbs. The major con is the constant surge of power through the poor chain: A pro cyclist can generate roughly 400 watts of power over an hour. Most humans with normal-size thighs can’t manage even half that. But e-bikes can generate up to 750 watts of continuous power. It’s why most mid-drive e-bikes come with upgraded chains. And if that chain snaps, you’re not going anywhere, just as on an old-school bike.

On the upside, newer mid-drive motors are notably smaller and lighter than hub units. Hidden inside frames, they’re making some e-bikes look so stealthy that onlookers have no idea it’s electric.

For both types, a speed sensor or torque sensor detects pedal force or wheel rotation, and activates the motor for a helpful forward shove. Riders can typically adjust the level of electric assist, or just pedal harder for a corresponding boost in motor grunt. But mid-drive brings another advantage, with genuine torque sensors to detect the human power applied at the pedal crank, and smoothly dial in electric assist. Hub motors often use a simple cadence sensor at the wheel, and can produce jerky or unpredictable motor boost, especially going uphill.

A big issue with e-bike range claims is that there are so many variables: Rider weight, wind and tire resistance, varying terrain and topography. Some electric bike companies claim up to 80 or even 100 miles of unassisted range, but expert riders say that would only be possible if most those miles were downhill. As a general rule of thumb, throttle e-bikes that combine a 500-to-750 watt motor and a 480 watt-hour (Wh) battery can cover only about 20 miles at best on battery power alone; or less than 25 watt-hours per mile.

Pedal-assisted bikes go farther: Figure about 15 watt-hours per mile, or 32 miles from that same 480 Wh battery, with a roughly “medium” level of preset electric assist. The price of that electric boost is weight. A lithium-ion battery usually adds a significant 6 to 8 pounds to the bike; weight that your legs must drive once its energy is depleted.

Batteries can be mounted on rear racks for easy access and removal, at the price of less-than-ideal location: Too high and too rearward, which can affect handling. Batteries externally mounted on the downtube — the bar directly below the saddle — eliminate that issue, keeping weight low and along the bike’s main axis. Batteries integrated inside the downtube create the sleekest profile, making these e-bikes look less bulky and more like a traditional cycle.

Spurred by PeopleForBikes, a national advocacy group and industry trade association, more than 30 states have adopted a “3-Class” system that standardizes e-bikes based on their type of assist and how fast they can propel you. All three classes limit a motor’s go-power to 750 watts, or 1 horsepower.

Class 1 e-bikes generate an electric boost only when you pedal, and reach a maximum assisted speed of 20 mph.

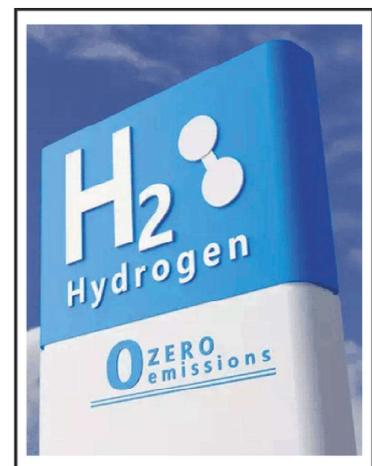
Class 2 models also limit assisted speed to 20 mph. But they add a hand throttle, either a grip-twist as found on motorcycles, or a button that can drive the electric motor even when you’re not pedaling.

Class 3 bikes are the muscular alternative to Class 1. They’re also exclusively pedal-assisted, but with a maximum boosted speed of 28 mph. Look out, LeMond: That’s roughly as fast as a professional bicyclist can maintain speed for long distances over flat ground.

## **ReNew, L&T ANNOUNCE PARTNERSHIP FOR GREEN HYDROGEN BUSINESS IN INDIA**

Larsen & Toubro (L&T), India’s leading engineering conglomerate, and ReNew Power (“ReNew”) (NASDAQ: RNW, RNWW) India’s leading renewable energy company, today announced a partnership agreement to tap the emerging green hydrogen business in India. Under this agreement, L&T and ReNew will jointly develop, own, execute and operate green hydrogen projects in India.

Commenting on this partnership, S N Subrahmanyam, CEO & MD of Larsen & Toubro said: “This partnership with ReNew is a significant milestone in the journey towards building a green energy portfolio for L&T. It is synergistic and brings together the impeccable track record of L&T in designing, executing, and delivering EPC projects and the expertise of ReNew in developing utility-scale renewable energy projects. We believe that green hydrogen is a promising alternate fuel and an important lever for achieving a cleaner future. L&T is



extremely keen to add value in this space beyond the traditional EPC approach and is looking forward to working with ReNew.”

“We are delighted to be partnering with L&T for the green hydrogen business. Green hydrogen will be a key driver of the transition to cleaner sources of energy and this partnership between ReNew and L&T, will allow both companies to pool their knowledge, expertise and resources to take maximum advantage of this transition. I expect this partnership to



set new benchmarks in the Indian renewable energy space and look forward to working together with L&T,” ReNew’s Chairman & CEO Sumant Sinha said, in a media statement.

“We are pleased to begin our journey with ReNew. This partnership will strategically place L&T and ReNew in a position to offer green hydrogen solutions to the industry. We are already looking at some interesting opportunities in the Indian market for green hydrogen and we intend to capitalize on them by developing end-to-end competitive solutions. In that effort, we are excited to secure a partnership with ReNew who brings its renewable energy development expertise to the table. Combined with our expertise in the EPC space, I am confident that this partnership will contribute to a sustainable and eco-friendly profitable growth.” Subramanian Sarma, Whole-time Director & Sr. Executive Vice President (Energy), Larsen & Toubro said on this occasion.

Green hydrogen produced by splitting water into hydrogen and oxygen in an electrolyzer by using renewable-powered electricity can enable the world to meet its net zero emissions targets. Many countries, including India (through its National Hydrogen Mission), have announced specific policy interventions to push for the widespread adoption of green hydrogen.

For countries like India, with its ever-increasing energy import bill, it can also provide energy security by reducing the overall dependence on fossil fuels. It is also expected to provide a green alternative for “hard-to-abate” industries, like refineries, fertilizers, steel and transport.

It is anticipated that green hydrogen demand in India for applications such as refineries, fertilizers and city gas grids will grow up to 2MMTPA by 2030 in line with the nation’s green hydrogen mission. This would call for investments upward of \$60 billion.

L&T, with its deep expertise and experience in engineering and construction of projects, and ReNew, with its experience in the development of renewable energy projects, are market leaders in their respective sectors and this synergistic partnership is committed to tapping this emerging opportunity.

## NTPC IN PACT WITH INDIAN OIL FOR COLLABORATION ON RENEWABLE ENERGY

New Delhi, 12 November, 2021: NTPC Ltd. and Indian Oil signed a memorandum of understanding (MoU) to collaborate in the field of renewable energy and mutually explore opportunities for supply of low carbon/RE RTC captive power.



The MoU was signed today at New Delhi in the presence of Shri Gurdeep Singh, CMD-NTPC, Shri Shrikant Madhav Vaidya, Chairman Indian Oil and Shri C K Mondol, Director (Commercial), NTPC, Shri SSV Ramkumar Director R&D and P&BD Indian Oil. The signatories of the MoU were Ms. Sangeeta Kaushik, Chief General Manager (BD) NTPC and Shri V K Raizada, Executive Director (M&I) Indian Oil.

This is a first-of-its-kind novel initiative by two leading national energy majors of India, to support the country's commitment to achieve renewable energy targets & reduce greenhouse gas emissions. Shri Gurdeep Singh, CMD, NTPC, said, "NTPC is taking various steps to make its energy portfolio greener by adding significant capacity of renewable energy sources so that our non-fossil fuel-based capacity will become equal or greater than our thermal portfolio by 2032. Through this MoU, the strengths of both the organizations can be leveraged to achieve the aim of the country to meet its net zero commitments."

Speaking on the occasion, Mr. Shrikant Madhav Vaidya, Chairman, Indian Oil said, "As a global energy major, environmental priority is being weaved into every business aspect of Indian Oil and now, we intend to use green energy to power new projects and refinery expansions."

NTPC and Indian Oil has come together for generation and storage of renewable energy or other forms of energy, including gas-based power, primarily to cater for Indian Oil refineries or other installations.

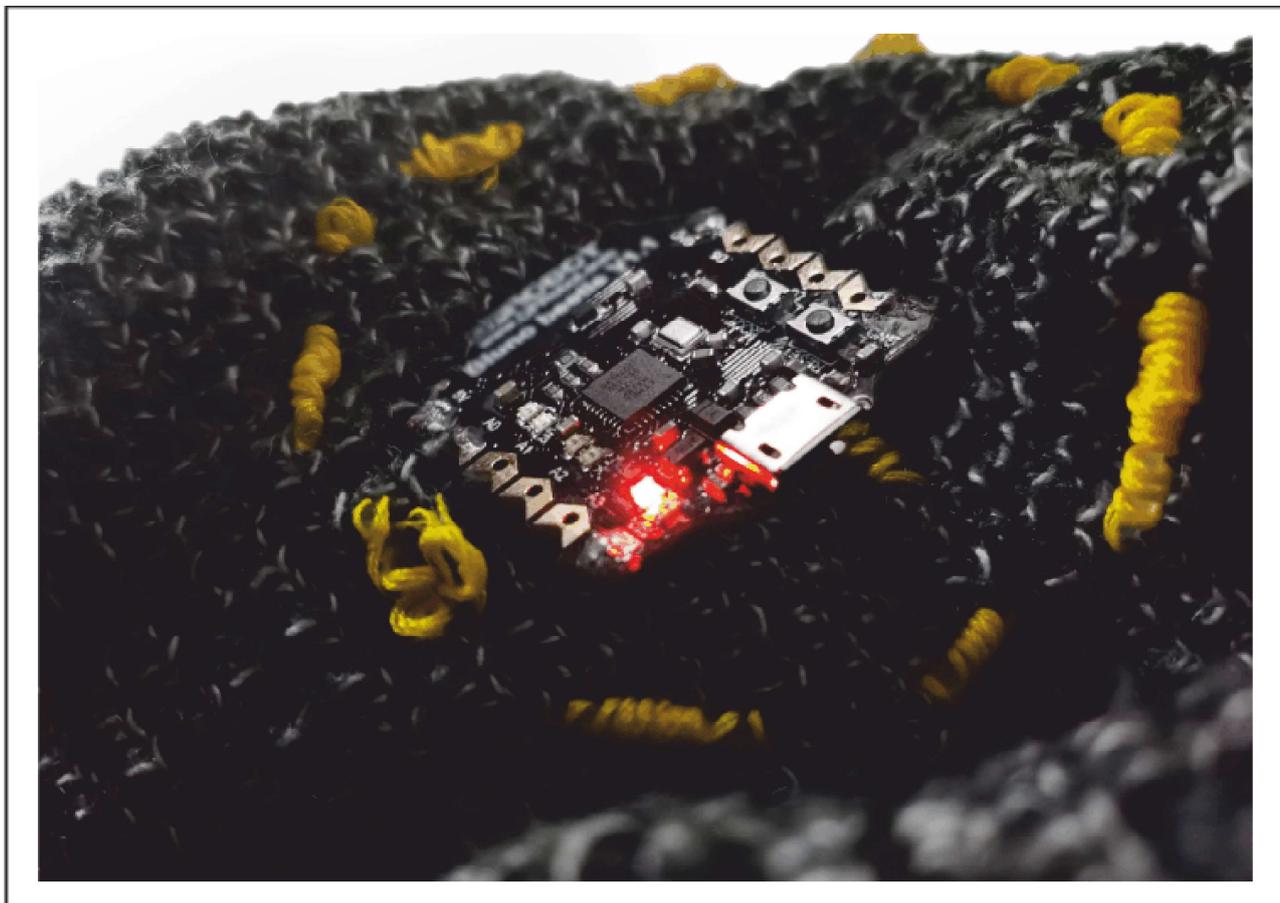
NTPC Ltd, India's largest integrated energy company, present installed capacity is 67,657.5 MW (including 13,425 MW through JVs/Subsidiaries) comprising of 47 NTPC stations (23 coal-based stations, 7 gas-based stations, 1 hydro station, 1 small hydro, 14 solar PV and 1 wind-based station) and 26 joint venture stations (9 coal based, 4 gas based, 8 hydro, 1 small hydro 2 wind and 2 solar PV).

***When it comes to climate protection, saving energy is the "sleeping giant".***

***– FRANZ***

## FIBER BATTERIES POWER SMART CLOTHES ZINC ION BATTERY FIBERS COULD BE BOON FOR OFF-THE-RACK WEARABLES

Millimeter-thin wirelessly rechargeable fiber batteries can be woven into clothing to help serve as the hub for a wearable network of electronics, a new study finds.



Wearable electronics are becoming increasingly popular, with a total market worth nearly \$80 billion in 2020, tripling in terms of annual revenue since 2014, according to emerging technology analyst firm IDTechEx in Cambridge, England. As such, researchers have sought to develop more and more powerful sources of energy for wearable devices that are also flexible enough to conform comfortably to the human body.

Although flexible supercapacitors possess high power density, their relatively low energy density and short durations of discharge limit their practical applications. Flexible lithium-ion batteries have a higher energy density, but there are fundamental concerns about their safety that restrict their widespread adoption in wearable technology.

Enter zinc ion batteries, a promising flexible energy-storage technology for wearables that theoretically possesses high capacity at low cost with good safety. However, the gel electrolytes

*The only way forward, if we are going to improve the quality of the environment,  
is to get everybody involved. – **RICHARD ROGERS***

that help electric charge flow within these batteries have proven challenging to fabricate, and often have poor mechanical properties and low ion conductivity.

Now scientists have developed rechargeable zinc ion batteries with relatively high energy densities of 91 watt-hours per liter, comparable to lithium-ion battery energy densities of 250 to 670 watt-hours per liter. They could fabricate the batteries as fibers just one millimeter in diameter, which proved roughly as elastic as human skin, capable of stretching 230% without breaking, low cost at \$0.64 per 15 centimeters, and lightweight at 1.26 grams per 15 centimeters.

“Smart clothes are our goal,” says study lead author Xiao Xiao, an electrical engineer at the University of California, Los Angeles.

The new zinc-manganese dioxide battery uses an electrolyte made in a simple and scalable way from two common materials, a polyvinyl alcohol hydrogel and graphene oxide flakes, Xiao says. The flakes sprinkled evenly throughout the hydrogel help give the electrolyte a high ion conductivity of 21 millisiemens per centimeter, roughly comparable to electrolytes used in lithium-ion batteries. The hydrogel made the electrolyte flexible and even capable of self-healing—when the material got cut, bringing the cut pieces in contact was enough to bond them back together.

Previous research developed a yarn-like zinc ion battery for use in smart clothes. However, this prior work displayed lower energy densities and also depended on relatively expensive carbon nanotubes, whereas this new work may be more scalable due to its use of graphene oxide flakes.

In experiments, the new fiber batteries displayed stable performance over more than 500 hours of discharging and recharging, maintaining 98% capacity after more than 1,000 such cycles. When connected to a wireless charging terminal, the scientists noted these batteries could wirelessly charge or get wirelessly charged by smartphones or other devices.

By encapsulating these fibers in silicone, the researchers made these batteries stable in air and waterproof enough to supply power even when submerged in water. These sheaths also protected human skin from the batteries.

The researchers suggested this wearable power supply could serve as the hub for a textile body area network (TBAN), analogous to the local area networks that link computers and peripherals in homes and offices. Inspired by this idea, they incorporated their fiber batteries into a shirt in which they embedded multiple sensors, circuits and a wireless charging terminal as well. The garment could measure heart rate, temperature, humidity and altitude signals and wirelessly send this data to a smartphone via Bluetooth, and a volunteer wore and tested it as they climbed to show it could work outdoors during exercise.

“We believe that a fiber-battery-powered TBAN will become the direction of future smart clothes, and this work will provide a promising roadmap toward personalized healthcare,” Xiao says.

This prototype garment employed rigid sensors. In the future, the scientists aim to develop flexible sensors, as well as fabrics that can harvest the energy from bodily motions to generate electricity, and even textile screens, Xiao says.

“Our goal is to make the smart fabric comfortable to use outside, and durable for outdoor activities such as mountain climbing and hiking,” he adds.

*I feel more confident than ever that the power to save the planet rests with the individual consumer. – DENIS HAYES*

## **ENERGY – GLOBAL MISSION AND INITIATIVES INDIA’S COMMITMENTS AND STRATEGIES - 2**

**Sustainable Growth, Sustainable Energy and Renewable Energy.**

**We have seen the details about the Global Plans and ambitious Road Map of the World for Net Zero Emission by 2050.**

There was Cop26 meeting in November ‘21 with participation of almost all countries of the World including India. We will see some details and India’s pronouncements and commitments in connection with the Global plans, which are also very significant and ambitious.

**Wind and Solar Initiatives have been in the forefront ever since with lot of investments, visibility and progress in India and across the World.**

**Bioenergy which is a ‘Firm Energy’ (24x365) as against Wind and Solar which are ‘Infirm Energy’ (Seasonal and part of the day only), require investments in Innovation and Technology as India has a huge potential.**

**COP26 is not just about India’s commitment to climate change. It’s also a message to the US**

India’s headlining commitments on climate change came with another message that shouldn’t be skipped over. Earlier this week, Prime Minister Narendra Modi stood on a global stage to announce climate commitments that surprised the world. Months after seemingly resisting the pressure from high-income countries to “do more” to save the planet, India changed its mind and offered the world more than what it was expecting.

The global stage in question is the 26th Conference of Parties (COP26) taking place in Glasgow right now. Countries have come together to figure out how to slow global warming, and even though these negotiations take place annually, the conference has taken on a new fervour since the Intergovernmental Panel on Climate Change (IPCC) warned that humanity will have already missed the bus, sending the earth down a path of irreversible man-made destruction, unless substantial action takes place now.

A cursory look at headlines coming out of COP26 includes everything from leaders urgently signing pledges to cut back on coal and deforestation to reports calling out high-income countries for making hollow promises. With a renewed urge to stop climate change, world leaders seem to be at least talking the talk. Only time will tell if they will walk the walk. This is why COP26 is the news maker.

### **India at the COP26**

At the podium, Modi made five new promises that experts agree are all ambitious, but could go one way or the other in practice.

In its new pledges, India said it would, by 2030, increase its installed renewable capacity to 500 gigawatts, install 50 per cent of its power capacity through non-fossil fuel resources, reduce carbon emissions by 1 billion tonnes, and reduce the carbon emissions intensity of the economy by 45 per cent.

**It also said it would reach net-zero emissions — removing as much carbon dioxide from the atmosphere as is produced — by 2070.**

For the world’s third-largest emitter (we emitted 2.88 billion tonnes of carbon dioxide last year) this is a lot. Practically, this means phasing out coal, which fuels 70 per cent of our electricity, switching to electric vehicles, decarbonizing polluting industries like cement and steel, creating forests to absorb carbon dioxide, and installing more solar power plants, all in the next few decades.

Our next-door neighbour, China, didn’t make any new commitments despite being the world’s largest carbon emitter today — responsible for 11 per cent of all emissions. The United States, critics have said, should have pledged net-zero emissions much before 2050 to make up for its historical emissions causing global warming today.

It's in this context that India, a country that only ranks 131 in the Human Development Index, and still has a long way to go when it comes to eliminating widespread poverty, is being praised.

India's stance, however, wasn't always this clear. Just a few short months ago, on more than one occasion, it politely declined to pledge net-zero emissions, arguing that countries should instead deliver on the promises they had made in the past. Reports have shown that India is among the few countries on track to deliver on its Paris Agreement targets — the goals set during the 21st COP.

When the IPCC warned that countries must cut emissions and reach net-zero by 2050, India said its stance had been “validated” and that it was on developed countries to make deep cuts.

### **Push for renewable by 2030, net-zero emissions by 2070:**

India will achieve net-zero emissions by 2070, PM Modi said at the COP26 global climate summit in Glasgow. He also made four other commitments, on behalf of India, to mitigate climate change.

Some of the important points made by the PM of India areas under:

- India is the only country delivering in ‘letter and spirit’ on Paris Declaration: PM Modi
- PM said developed countries must ensure 1 trillion dollar climate finance at the earliest
- The world today admits that lifestyle has a major role in climate change: PM Modi at COP26 summit

Delivering the national statement at the **COP26 global climate summit in Glasgow**, PM Narendra Modi said India will achieve **net-zero emissions by 2070**. This was one of the **five major commitments** he made on behalf of India, to mitigate climate change.

Terming the commitments as “*panchamrit*”, India's gift to the world, the PM reiterated that India is working very hard on tackling climate change-related issues.

“India is the only country that is delivering in ‘letter and spirit’ on the **Paris Declaration** commitments on tackling climate change,” PM Modi said.

India, which is home to **17 per cent of the world's population**, accounts for only about **5 per cent of total (greenhouse gas) emissions**, Prime Minister Narendra Modi said in Glasgow.

### **The five commitments PANCHAMRUT made at COP26:**

- India will achieve **net-zero emissions by 2070**
- India will bring its **non-fossil energy capacity to 500 GW by 2030**
- India will bring its economy's **carbon intensity down to 45 per cent by 2030**
- India will fulfill **50 per cent** of its **energy requirement through renewable energy by 2030**
- India will **reduce 1 billion tonnes of carbon emissions** from the total projected emissions **by 2030**

In addition, PM Modi also used the platform to give out a call for a global movement for sustainable development.

“The world today admits that lifestyle has a major role in climate change. I propose a one-word movement before all of you. This word is **LIFE**, which means **Lifestyle for Environment**. Today, it is needed that all of us come together and take forward LIFE as a movement,” the PM said.

Recalling the **Paris Climate Agreement**, the Prime Minister said he had no intention to add his own promise to commitments made by other nations.



*(To be continued)*

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***Each year one square kilometre of desert receives solar energy equivalent to 1.5 million barrels of oil. – Unknown***

## TIRUKKURAL ON WEALTH AND ECONOMY

The Pandemic has resulted in slowing down of various economies of the World including that of India and the recoveries are encouraging. Post Pandemic, India is hoping to regain back the fast growth towards achieving much higher levels in comparison to top economies of the World. The importance of wealth and the power of it to face the World at large with friends and enemies are very clearly dealt by Thiruvalluvar in a number of Kurals.



The 2 Kurals below will illustrate the role and the power of wealth.

**Porulennum Poyya Vilakkam Irularukkum  
Enniya Theyaththch Chendru Kural 753**

பொருளென்னும் பொய்யா விளக்கம்

இருளறுக்கும்

எண்ணிய தேயத்துச் சென்று. குறள் 753

**“The un flickering light called wealth  
lighteth up all dark places unto him that  
posseseth it “**

This Kural can also intrepreded as the power of wealth to counter the darkness of enmity with any country.

**Seyga Porulaich Cherunar Cherukkarukkum  
Ekhthanir Kooriya Thill Kural 759**

செய்க பொருளைச் செறுநர் செருக்கறுக்கும்

எ.:கதனிற் கூரிய தில். குறள் 759

**“Amass wealth: for there is no sharper steel  
to cleave thy foeman’s pride.”**

## HUMOUR

Q: Why couldn't the boy add 10 + 5 on a calculator?

A: He couldn't find the “10” button.

Q: What do computers eat for a snack?

A: Microchips!

Q: What computer sings the best?

A: A Dell.

I decided to make my password “incorrect” because if I type it in wrong, my computer will remind me, “Your password is incorrect.”

What does an air conditioner have in common with a computer? They both lose efficiency as soon as you open windows.

Q: What did the spider do on the computer?

A: Made a website!

Kriss: My internet is not working properly..o

Officer: Ok, Double click on “My computer”

Kriss: I can't see ur computer..

Officer: No no.. click on “My computer” on ur computer..

Kriss: How can I click on ur computer from my computer?..

Officer: listen.. There is an icon labelled “My Computer” on ur computer.. Ok. double click on it..

Kriss: what the hell, what is your computer doing on my computer..???

Officer: Double click on ur computer..

Kriss: On which Icon i've to click..

Officer: “My Computer”..

Kriss:...Oh u Idiot..... Tell me where is ur office...I'll come there and click on ur “Computer.

Me: Siri, where is the best place to hide a body?

Siri: The second page of a Google search.

Q: Why shouldn't Facebook have paid \$1 billion dollars for Instagram?

A: They could've downloaded it for free!

Q: What did the computer do at lunchtime?

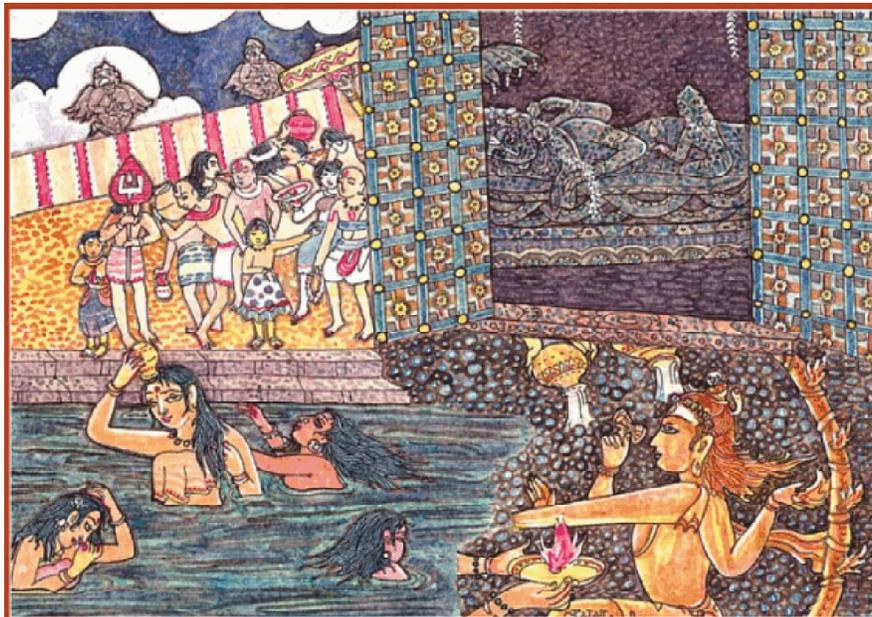
A: Had a byte!

***The ecological crisis is doing what no other crisis in history has ever done —  
challenging us to a realization of a new humanity.***

**— JEAN HOUSTON**

## HOME FESTIVALS - 12

### Markazhi (December/January)



During Tirupuvai (below, in upper left of painting), people bathe (lower left) and gather in the early morning to go on procession singing devotional Vaishnava songs (upper left). Especially popular are those of the 9<sup>th</sup> century lady saint Andal, venerated as one of South India's greatest devotional poets. On **Vaikunth Ekadasi**, the 11<sup>th</sup> day of the lunar month, the doors of the huge temple of Srirangam

are opened to devotees from morning to night for darshan of Rangam, an aspect of Lord Vishnu, sleeping on Adishani, the serpent king (upper right). Another famed festival is **Ardra Darshana**, when Siva Nataraja is decorated and taken from the temple in procession throughout the community (lower right). Especially the ill and those of old age seek to have a glimpse of Nataraj. A renowned sweet, **aurudra kalli**, is made with vegetables on this day.

*“All of these festivals are earnestly conducted. People wait for the day with their mind on God. The purpose is to gather in the home and worship for the prosperity of the family and of all mankind.”*

## HOME FESTIVALS - 1

### Thai (Mid-January/Mid-February)



At left the Sun god, Surya, is being worshipped with the outdoor cooking of a large pot of rice from the recent harvest. The overflowing of the dish

is called “**pongalo-pongol**”, and thus this festival is known as **Thai Pongal**. Other crops, like sugarcane, bananas and turmeric, are also offered. *Kolams* (hand-made rice flour patterns) are drawn in the form of the chariot, with the Sun and Moon in the centre. On this day cows and other animals are decorated and fed special foods, and their owners prostrate to them. Crows and other birds are offered food on leaves of turmeric. Sisters pray for the welfare of brothers, and elders bless the children. **Thai Pongal is celebrated by the poorest farmers and the wealthiest householders.**

*(To be continued)*

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